

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

EURL-PT-POP_2502-HY

FEED

Final Report PBDEs and HBCDDs (Report Version 1.1)

25 June 2026



Funded by
the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Health and Digital Executive Agency (HADEA). Neither the European Union nor the granting authority can be held responsible for them.



Summary

Test sample	FEED: Hay [2502-HY]
Analytes of interest Mandatory for NRLs:	PBDEs (BDE-28, -47, -49, -99, -100, -153, -154, -183, -209) HBCDDs (α -HBCDD, β -HBCDD, γ -HBCDD or total HBCDD)
Methods	Any kind of method
Participants	NRLs, OFLs, other official laboratories, commercial laboratories performing the analysis of samples taken by feed business operators
Statistical evaluation	ISO 13528:2022 [1], IUPAC Protocol [2]
Final report	25 June 2026 (Version 1.1) Annex 8: Participants' results – Tables – HBCDDs Annex 9: Participants' z-scores – Tables – HBCDDs
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 PT, test material and analytes

This proficiency test (PT) on the determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in **Hay** was organized by the EURL for halogenated POPs in Feed and Food to be performed between August and November 2025. The objective is 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 **Hay**.

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. **Other official laboratories** and **commercial laboratories** performing the analysis of samples taken by feed business operators were invited to participate in this proficiency test.

The evaluated results were discussed by representatives of European Commission, NRLs and the EURL at the EURL/NRL workshop on 26 November 2025.

1.1. Samples and coding

The test sample was prepared from contaminated feed from a feeding study and fortified with some analytes of interest using analytical standards or technical mixtures of PCDD/Fs, PCBs, PBDEs and HBCDDs.

Hay	Sample no. 2502-HY-xxx
------------	-------------------------------

Each participant received about **90 g** of the test sample in a HDPE bottle.

1.2. Analytes of interest

Participants were requested to determine the following parameters:

Polybrominated diphenyl ethers (PBDEs)

- Individual congeners: BDE-28, -47, -49, -99, -100, -153, -154, -183, -209
- Sum of 8 PBDEs (without BDE-209)
- Sum of 9 PBDEs (with BDE-209)

Hexabromocyclododecanes (HBCDDs)

- α -HBCDD, β -HBCDD, γ -HBCDD stereoisomers
- Sum of α -, β -, γ -HBCDD (using HPLC methods)
- Total HBCDD (using GC methods)

1.3. Methods

All kinds of detection and quantification methods could be applied.

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 PBDEs and HBCDDs

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,
- 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 **µg/kg, relative to a feed with a moisture content of 12 %**, for PBDEs and HBCDDs.

2. Participating laboratories

This proficiency test was open for participation of:

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

92 laboratories registered for this proficiency test. For PBDE and HBCDD, 26 and 18 sets of results were reported, respectively. Two laboratories laboratory submitted second sets of data for PBDE and one for HBCDD.

Table 1: Participating laboratories

Participating laboratories	Region	No. all participants	No. participants PBDE/HBCDD
National Reference Laboratories	European Union	24	16/15
	Other Countries	2	-
Official Laboratories	European Union	53	5/7
	Other European Countries	1	-
	Africa	-	-
	Americas	2	-
	Asia	-	-
	Oceania	-	-
Commercial Laboratories	European Union	9	3/2
	Other European Countries	-	-
	Africa	-	-
	Americas	1	-
	Asia	-	-
	Oceania	-	-
	Total	92	24/24

2.1. Number of reported results

Table 2: Reported results for PBDEs and moisture content for Hay (2502-HY)

Reported results (2502-HY)	All laboratories
BDE-28, 47, 99, 100, 153, 154, 183	26
BDE-49, 209	25 / 22
Sum of 8 PBDEs (without BDE-209) (ub)	25
Sum of 8 PBDEs (without BDE-209) (lb)	25
Sum of 9 PBDEs (with BDE-209) (ub)	22
Sum of 9 PBDEs (with BDE-209) (lb)	22
Moisture content	23

Table 3: Reported results for HBCDDs for Hay (2502-HY)

Reported results (2502-HY)	All laboratories
α -, β -, γ -HBCDD	18
Sum of α -, β -, γ -HBCDD (ub)	18
Sum of α -, β -, γ -HBCDD (lb)	18
Total HBCDD (using GC methods)	-
Moisture content	17

2.2. Accreditation

Table 4: Reported accreditation according to ISO/IEC 17025 by participants for PBDEs and HBCDDs

Hay	PBDEs	HBCDDs
Accreditation	17	9
No accreditation	5	7



2.3. Detection methods

The following detection methods were applied:

- GC-HRMS-, GC-MS/MS-methods for PBDEs
- GC-HRMS-, GC-MS/MS-, LC-MS/MS-, LC-HRMS-methods for HBCDDs

Table 5: Overview of chromatographic separation and detection methods for the determination of PBDEs and HBCDDs for Hay (2502-HY)

Detection methods	PBDEs	HBCDDs
GC-HRMS	15	-
GC-MS/MS	9	2
GC-NCI-MS	-	-
LC-MS/MS	-	13
LC-HRMS	-	1

3. Test for sufficient homogeneity

The test for sufficient homogeneity was performed according to ISO 13528:2022 [1] and the International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories [2]. Therefore, 10 portions of the test samples 2502-HY were analyzed in duplicate for PBDEs. The test for sufficient homogeneity was performed for individual congeners and sum parameters. The test materials showed sufficient homogeneity and stability for PBDEs for this proficiency test. Homogeneity and stability can be concluded also for HBCDDs, due to similar physico-chemical properties.

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 individual PBDE congeners, sum of 8 (without BDE-209) and sum of 9 (with BDE-209) PBDEs, for individual HBCDD diastereomers, sum of α -, β - and γ -HBCDD and total HBCDD (including limits of quantification (LOQs)), if possible. Additionally, the median of all values was calculated.

For individual congeners/diastereomers (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 taken for evaluation and calculation if these levels are equal to or above the LOQ; otherwise, the LOQ will be taken instead.

Due to high variation of participants' results in the range of the respective LOQ or too few results, no assigned values could be calculated for:

- (+/-)- β -HBCDD
- Total HBCDD (using GC-methods)

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 the results of the participants. Additionally, the results of all participants reporting results and the results of participants having accreditation according to ISO/IEC 17025 were compared for PBDE sum parameters. 21 of 29 participating laboratories were accredited according to ISO/IEC 17025 for PBDEs. No significant differences (0 to 3 %) between the assigned values calculated for both data sets for PBDEs were observed. For HBCDDs only 9 out of 29 participating laboratories were accredited according to ISO/IEC 17025. Therefore, no assigned values for HBCDDs could be calculated for this group of participants (Table 6).

Table 6: Comparison of assigned values for all participants and participants with reported accreditation according to ISO/IEC 17025 for PBDE and HBCDD sum parameters

Sum parameters	Assigned value	Assigned value	Deviation
	All participants	ISO/IEC 17025 accreditation	
	$\mu\text{g/kg product}$ (12 % moisture content)		%
Sum of PBDE without BDE-209 (ub)	0.625	0.627	<1
Sum of PBDE without BDE-209 (lb)	0.625	0.626	<1
Sum of PBDE including BDE-209	8.01	-*	
γ -HBCDD	0.907	-*	
Sum of α -, β -, γ -HBCDD	0.988	-*	

*too few results from accredited laboratories to calculate an reliable assigned value for comparison

4.1. PBDEs – individual congeners and sum parameter

The assigned values for the test sample 2502-HY were calculated as consensus of participants' results for individual PBDEs and sum parameters, taking into account the calculation criteria described above (Table 7; tabular summary see annex 1; Figure 1 and 2).

Table 7: Assigned values for PBDEs (rounded to three significant figures)

Hay (2502-HY)	Assigned value µg/kg product (12 % moisture content)
BDE-28	0.0105
BDE-47	0.210
BDE-49	0.00664
BDE-99	0.241
BDE-100	0.0520
BDE-153	0.0322
BDE-154	0.0220
BDE-183	0.0530
BDE-209	7.36
Sum of PBDE without BDE-209 ub	0.625
Sum of PBDE without BDE-209 lb	0.625
Sum of PBDE including BDE-209 ub	8.01
Sum of PBDE including BDE-209 lb	8.01

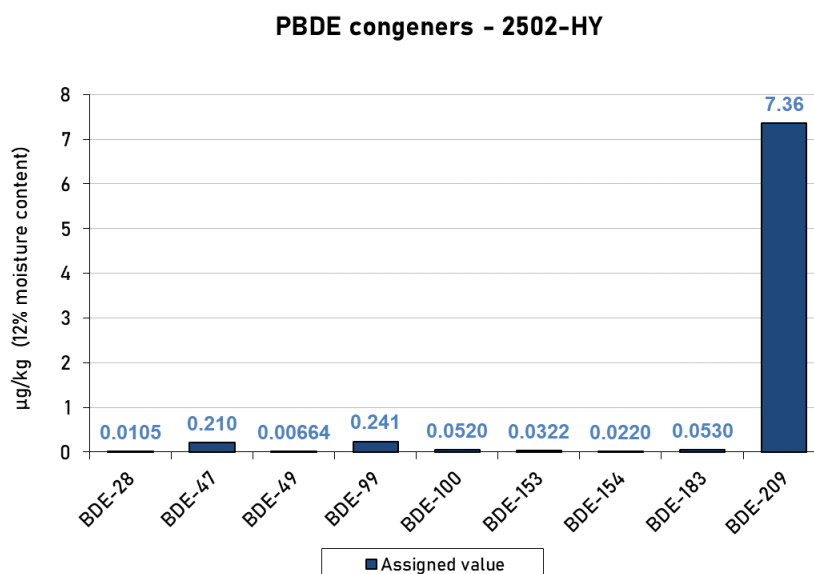


Figure 1: Assigned values (blue) for PBDE individual congeners for Hay (2502-HY) [µg/kg product (12% moisture content)]

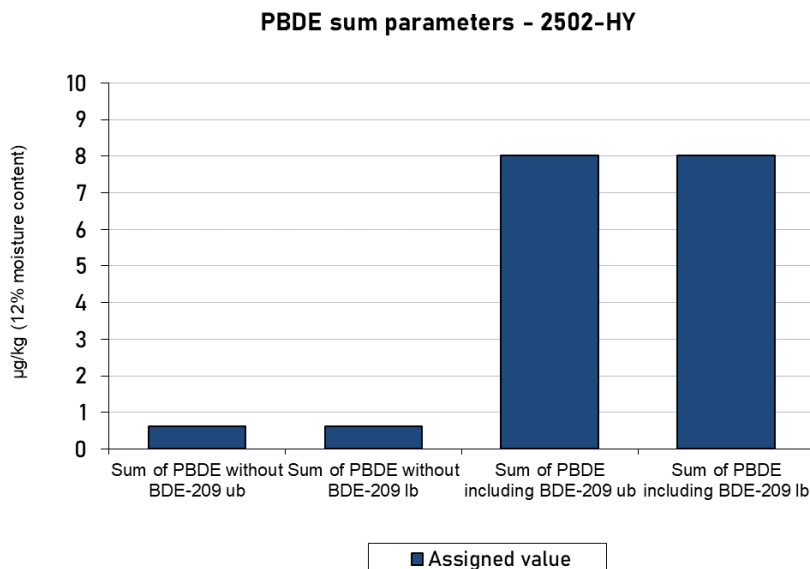


Figure 2: Assigned values (blue) for PBDE sum parameters for Hay (2502-HY) [$\mu\text{g}/\text{kg}$ product (12% moisture content)] y-axis scaled for better overview

4.2. HBCDDs – individual stereoisomers and sum parameter

The assigned values for the test sample 2502-HY were calculated as consensus of participants’ results for individual HBCDDs and sum parameters, taking into account the calculation criteria described above (Table 8; tabular summary see annex 7; Figure 3 and 4).

Table 8: Assigned values for HBCDDs (rounded to three significant figures)

Hay (2502-HY)	Assigned value $\mu\text{g}/\text{kg}$ product (12 % moisture content)
(+/-)- α -HBCDD	0.107
(+/-)- γ -HBCDD	0.969
Sum of α -, β -, γ -HBCDD (ub)	1.080
Sum of α -, β -, γ -HBCDD (lb)	1.07

HBCDD diastereomers - 2502-HY

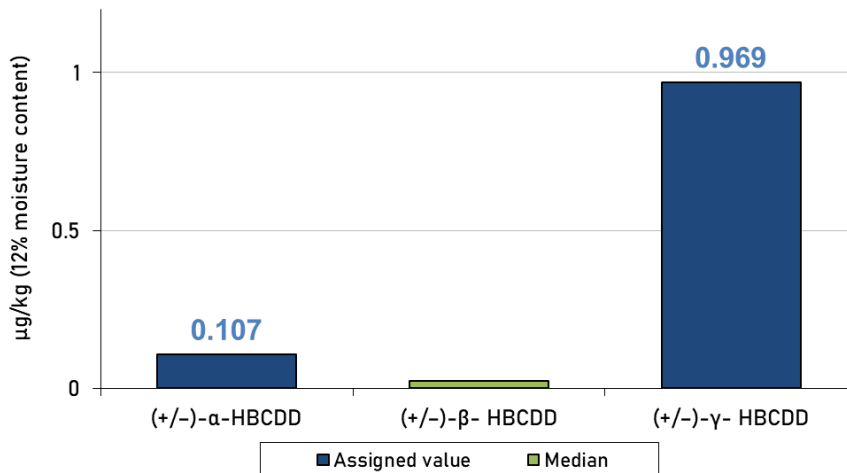


Figure 3: Assigned values (blue) and median values (green) for HBCDD individual congeners for Hay (2502-HY) [µg/kg product (12% moisture content)]

HBCDD sum parameters - 2502-HY

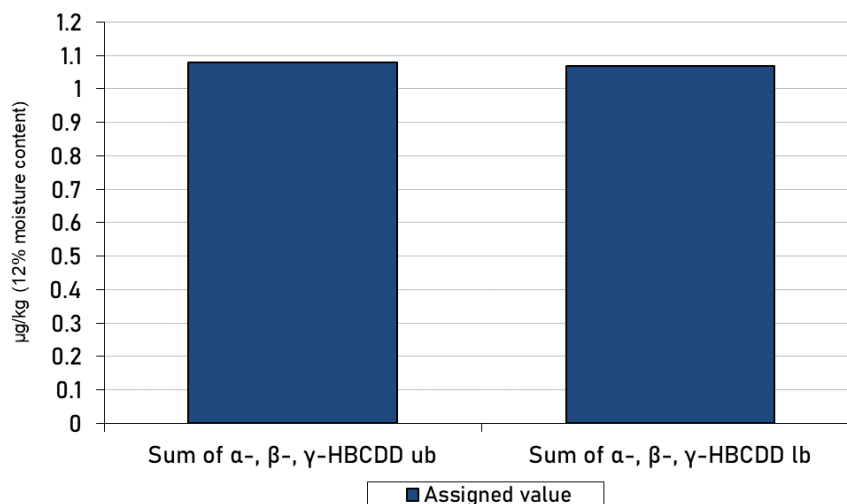


Figure 4: Assigned values (blue) and median values (green) for HBCDD individual congeners and sum parameters for Hay (2502-HY) [µg/kg product (12% moisture content)]

4.3. Moisture content

For the moisture content an assigned value of **8.34 %** for the test sample 2502-HY was calculated as a consensus of the participants' results, taking into account the calculation criteria described above. Participants' results are listed as tabular summary see annex 2, 8 and displayed graphically in figure 5 and 6.

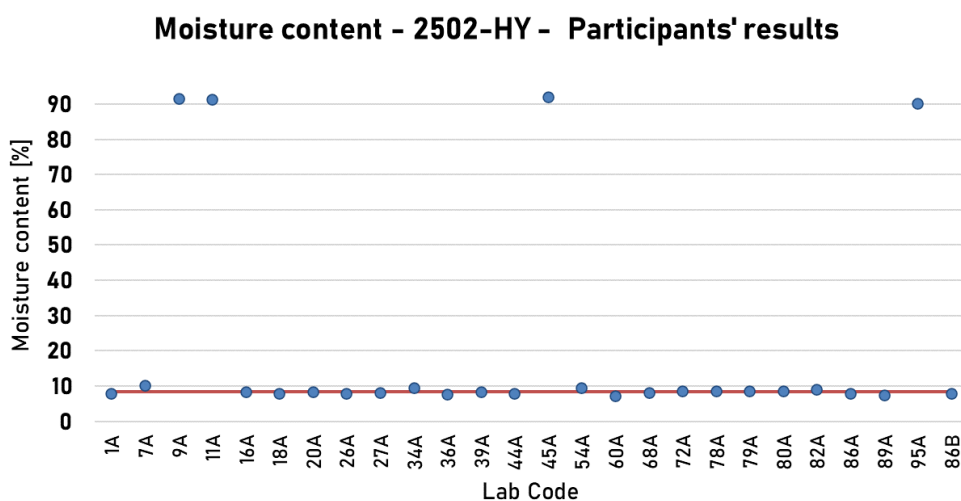


Figure 5: Participant's results of the moisture content in % for Hay (2502-HY)

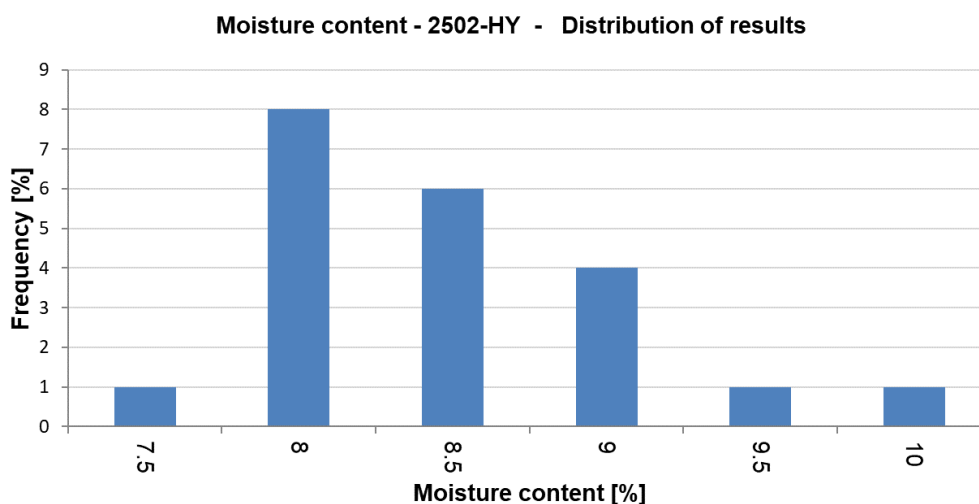


Figure 6: Frequency distribution of the participant's reported moisture contents in % for Hay (2502-HY)



4.4. Comparison of assigned values with recommended LOQs

The limits of quantification are currently based on the values specified in Commission Recommendation of 3 March 2014, on the monitoring of trace levels of brominated flame retardants in food (2014/118/EU). For PBDEs the recommended LOQ value is 0.01 µg/kg w.w. for individual congeners. However, it was discussed in the meetings of the core working group “Brominated Contaminants and PCNs” of the EURL/NRL network that for feed an LOQ value of 0.01 µg/kg product, compared to a feed with a moisture content of 12%, is preferable for all congeners and given that some feeds show concentrations below this an even lower targeted LOQ of 0.001 µg/kg product (12 % moisture content), except for BDE-209 was recommended (Table 9). Valid data on the background contamination of feedstuffs with BFRs is particularly important for a reliable risk assessment. For HBCDDs the recommended LOQ value is at 0.01 µg/kg product, compared to a feed with a moisture content of 12 % for α-, β- and γ-stereoisomers (Table 9). For total HBCDD measured by GC-MS, the corresponding LOQ value is 0.003 µg/kg product (12 % moisture content), as cumulative response of all possible HBCDD diastereomers (Table 9).

Table 9: Analytical recommendations from “Guidance document on analytical parameters for the determination of organobromine contaminants in food and feed” (CWG “BCons and PCNs”)

Undesirable Substances in Feed	Limit of quantification per congener/stereoisomer µg/kg product (12 % moisture content)
PBDEs	0.01 and 0.001 (all congeners except BDE-209)
HBCDDs	0.01 (sum of HBCDDs) and 0.003 (total HBCDD)

PBDEs:

Assigned values for BDE-28 (0.0105 µg/kg) and BDE-154 (0.0220 µg/kg) were in the range of the recommended LOQ (Table 9) and could be determined successfully by most of the laboratories. The BDE-49 concentration in this hay sample was below the recommended LOQ of 0.01 µg/kg (12% moisture content) with a calculated assigned value of 0.00664 µg/kg. It is the only BDE congener from this study without its own internal ¹³C-labelled standards, but could be determined by most of the laboratories very successfully in this study.

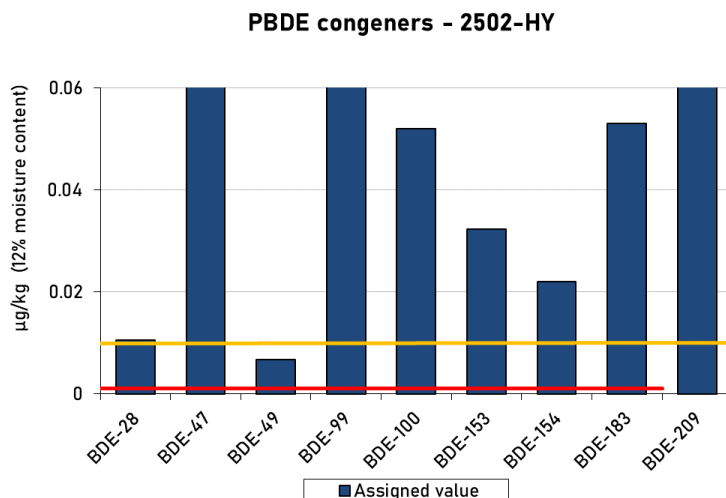


Figure 7: Comparison of assigned values for PBDE congeners with recommended LOQs (yellow line at 0.01 µg/kg product and red line at 0.001 µg/kg product) in Hay (2502-HY)

HBCDDs:

For alpha- and gamma-HBCDD assigned values could be calculated which are 10 to 100-times above the recommended LOQ in this hay sample. For β-HBCDD no assigned value could be calculated because less than two-thirds of all reported results were above the LOQs (see calculation criteria section 4). Therefore, the median value was taken for comparison with the recommended LOQ. The calculated median value for β-HBCDD is 0.0250 µg/kg and in the range of the recommended LOQ of 0.01 µg/kg product, showing that not all participating laboratories could reliably report results for β-HBCDDs in Hay in this low concentration range and reported as results values below their method LOQs.

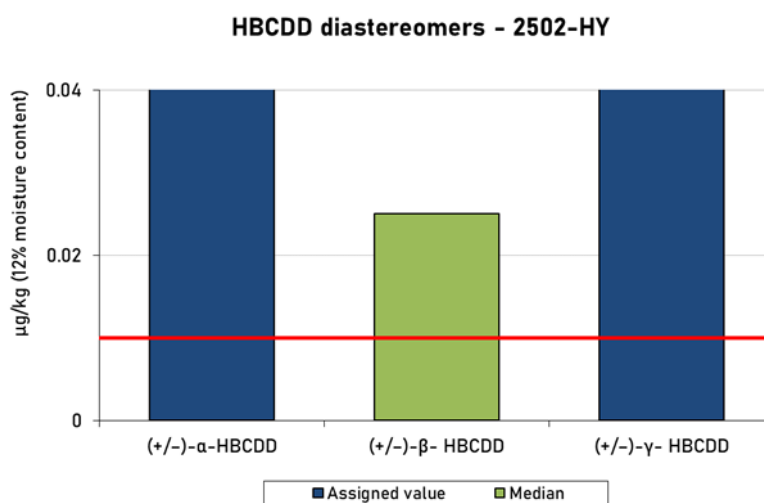


Figure 8: Comparison of assigned values for HBCDD stereoisomers with recommended LOQs (red line at 0.01 µg/kg product) in Hay (2502-HY)

5. Scoring of results – Z-scores

For evaluation of results, 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 individual PBDE congeners, individual HBCDD diastereomers and PBDE and HBCDD sum parameters, the relative standard deviation for proficiency assessment $\sigma_{p_{rel}}$ is defined as 20 %.

Z-scores for individual congeners / substances and diastereomers are 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. PBDEs - Participants' z-scores

Table 10: Distribution of participants' z-scores for individual PBDE congeners for Hay (2502-HY)

Percentage of participants' results	$ z\text{-score} \leq 2$	$2 < z\text{-score} < 3$	$ z\text{-score} \geq 3$
BDE-28	96%	-	4%
BDE-47	96%	-	4%
BDE-49	82%	9%	9%
BDE-99	92%	8%	-
BDE-100	92%	8%	-
BDE-153	96%	-	4%
BDE-154	96%	4%	-
BDE-183	96%	-	4%
BDE-209	73%	23%	5%

Table 11: Distribution of participants' z-scores for PBDE sum parameters for Hay (2502-HY)

Percentage of participants' results	$ z\text{-score} \leq 2$	$2 < z\text{-score} < 3$	$ z\text{-score} \geq 3$
Sum of PBDE without BDE-209 ub	92%	8%	-
Sum of PBDE without BDE-209 lb	92%	8%	-
Sum of PBDE including BDE-209 ub	82%	18%	-
Sum of PBDE including BDE-209 lb	82%	18%	-

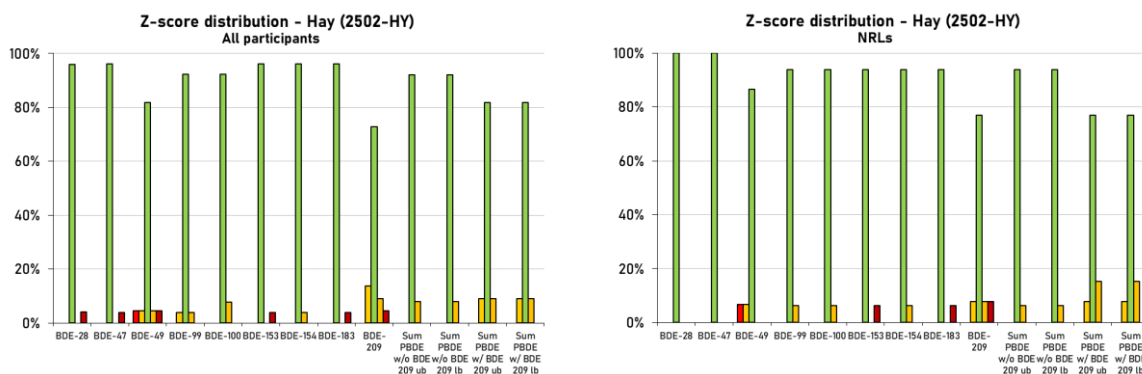


Figure 9: Distribution of participants' z-scores and NRLs only for PBDE congeners / sum parameters for Hay (2502-HY) [Green bars: $-2 \leq z\text{-score} \leq 2$, orange bars: $-3 < z\text{-score} < -2$, $2 < z\text{-score} < 3$, red bars: $z\text{-score} \leq -3$, $z\text{-score} \geq 3$]

5.2. HBCDDs - Participants' z-scores

HBCDD stereoisomers undergo thermal isomerization at temperatures above 160 °C. With GC elution temperature of these compounds of normally above 160 °C a separation of HBCDD stereoisomers using GC analysis is not possible. Only one unresolved peak is obtained. Additional thermal decomposition of HBCDDs is reported for temperatures above 240 °C. Therefore, in case of applying GC-MS methods for HBCDD analysis determination of total HBCDD (as sum of all originally present HBCDD diastereomers) is possible only.

Due to the low numbers of results for total HBCDD the sum of α -, β -, γ -HBCDD (using LC separation) would be taken for comparison.

Table 12: Distribution of participants' z-scores for HBCDD for Hay (2502-HY)

Percentage of participants' results	$ z\text{-score} \leq 2$	$2 < z\text{-score} < 3$	$ z\text{-score} \geq 3$
(+/-)- α -HBCDD	94%	-	6%
(+/-)- γ -HBCDD	83%	6%	11%
Sum of α -, β -, γ -HBCDD (ub)	78%	6%	16%
Sum of α -, β -, γ -HBCDD (lb)	78%	6%	16%

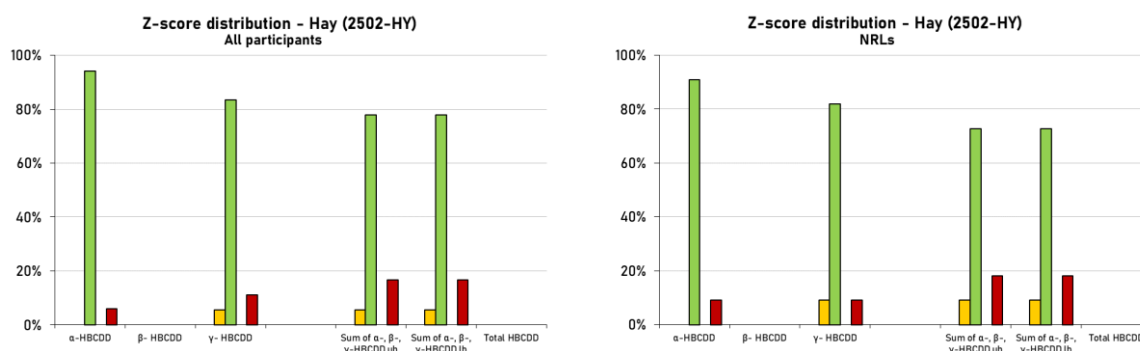


Figure 10: Distribution of participants' z-scores and NRLs only for HBCDD stereoisomers / sum parameters for Hay (2502-HY) [Green bars: $-2 \leq z\text{-score} \leq 2$, orange bars: $-3 < z\text{-score} < -2$, $2 < z\text{-score} < 3$, red bars: $z\text{-score} \leq -3$, $z\text{-score} \geq 3$]

6. 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).

7. Results of participants

An overview of the PBDE and HBCDD results for the PT test sample Hay (2502-HY) are given in the following annexes. Laboratories are coded according to the laboratory codes sent after registration.

8. 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.

9. Annex

Hay – 2502-HY	
Annex 1	Assigned values – PBDEs
Annex 2	Participants' results – Tables – PBDEs
Annex 3	Participants' z-scores – Tables – PBDEs
Annex 4	Participants' z-scores – Charts – PBDEs
Annex 5	Test for sufficient homogeneity and stability – PBDEs
Annex 6	Participants' methods – PBDEs
Annex 7	Assigned values – HBCDDs
Annex 8	Participants' results – Tables – HBCDDs
Annex 9	Participants' z-scores – Tables – HBCDDs
Annex 10	Participants' z-scores – Charts – HBCDDs
Annex 11	Participants' methods – HBCDDs



EURL for halogenated POPs in Feed and Food
c/o State Institute for Chemical and Veterinary Analysis of Food Freiburg

A handwritten signature in black ink, appearing to read 'Alex Schächtele', is written over a white background.

Coordinator: Alexander Schächtele
(Head of EURL POPs)

Phone: +49 761 8855 500 E-Mail: eurl-pops@cvuafr.bwl.de



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 1: Assigned values of PBDEs

Test sample - Hay (2502-HY)

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

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

PBDE - Assigned values

Analyte		Result µg/kg (12% moisture content)	Assigned value [outliers removed]	Robust standard deviation [outliers removed]	Standard uncertainty [outliers removed]	No. of results contributing to assigned value	Median [all values]
Sum of 8 PBDE	without BDE-209 (ub)		0.625	0.0787	0.021	23	0.630
Sum of 8 PBDE	without BDE-209 (lb)		0.625	0.0810	0.021	23	0.630
Sum of 9 PBDE	including BDE-209 (ub)		8.01	1.89	0.57	17	7.85
Sum of 9 PBDE	including BDE-209 (lb)		8.01	1.89	0.57	17	7.85
BDE-28	2,2',4-tribromodiphenyl ether		0.0105	0.00144	0.00038	22	0.0108
BDE-47	2,2',4,4'-tetrabromodiphenyl ether		0.210	0.0246	0.0064	23	0.212
BDE-49	2,2',4,5'-tetrabromodiphenyl ether		0.00664	0.00127	0.00035	20	0.00672
BDE-99	2,2',4,4',5-pentabromodiphenyl ether		0.241	0.0250	0.0065	23	0.240
BDE-100	2,2',4,4',6-pentabromodiphenyl ether		0.0520	0.00337	0.00090	22	0.0522
BDE-153	2,2',4,4',5,5'-hexabromodiphenyl ether		0.0322	0.00343	0.00089	23	0.0325
BDE-154	2,2',4,4',5,6'-hexabromodiphenyl ether		0.0220	0.00229	0.00060	23	0.0220
BDE-183	2,2',3,4,4',5',6'-heptabromodiphenyl ether		0.0528	0.00683	0.0018	23	0.0517
BDE-209	2,2',3,3',4,4',5,5',6,6'-decabromodiphenyl ether		7.36	1.87	0.57	17	7.18



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Moisture content (PBDE) - Assigned value

Analyte	Result %	Assigned value [outliers removed]	Robust standard deviation [outliers removed]	Standard uncertainty [outliers removed]	No. of results contributing to assigned value	Median [all values]
Moisture content		8.34	0.629	0.17	21	8.47



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 2: Participants' results of PBDEs

Test sample - Hay (2502-HY)

Hay (2502-HY)

PBDE - Results

LC	Data set	Sample	Result µg/kg 12% moisture content	Sum of 8 PBDE without BDE-209 (ub)	Sum of 8 PBDE without BDE-209 (lb)	Sum of 9 PBDE including BDE-209 (ub)	Sum of 9 PBDE including BDE-209 (lb)	2,2',4'- tribromodiphenyl ether BDE-28	2,2',4,4'- tetrabromodiphenyl ether BDE-47	2,2',4,5'- tetrabromodiphenyl ether BDE-49	2,2',4,4',5'- pentabromodiphenyl ether BDE-99	2,2',4,4',6'- pentabromodiphenyl ether BDE-100	2,2',4,4',5,5'- hexabromodiphenyl ether BDE-153	2,2',4,4',5,6'- hexabromodiphenyl ether BDE-154	2,2',3,4,4',5',6'- heptabromodiphenyl ether BDE-183	2,2',3,3',4,4',5,5',6,6'- decabromodiphenyl ether BDE-209
1		2502-HY														
2		2502-HY														
3		2502-HY														
4		2502-HY														
5		2502-HY														
6		2502-HY														
7	A	2502-HY		0.652	0.652	7.46	7.46	0.011	0.204	0.006	0.275	0.054	0.03	0.02	0.051	6.81
8		2502-HY														
9	A	2502-HY		0.622	0.622	7.42	7.42	0.0128	0.204	0.00634	0.234	0.0545	0.0331	0.0215	0.0557	6.8
10		2502-HY														
11	A	2502-HY		0.625	0.625	8.2	8.2	0.0116	0.192	0.00396	0.249	0.0557	0.0308	0.0222	0.0601	7.57
12		2502-HY														
13		2502-HY														
14		2502-HY														
15	A	2502-HY		0.416	0.416	7.49	7.49	0.01	0.209	0.007	0.239	0.052	0.035	0.023	0.051	6.87
16	A	2502-HY		0.641	0.641	10.9	10.9	0.01	0.231	0.00672	0.234	0.0519	0.033	0.0231	0.0508	10.3
17		2502-HY														
18	A	2502-HY		0.64	0.64	7.5	7.5	0.011	0.23	0.0056	0.24	0.049	0.032	0.021	0.05	6.89
19		2502-HY														
20		2502-HY														
21		2502-HY														
22		2502-HY														
23		2502-HY														
24		2502-HY														
25		2502-HY														
26	A	2502-HY		0.587	0.587	5.86	5.86	0.00892	0.201	0.00631	0.222	0.05	0.0303	0.0195	0.0486	5.27
27	A	2502-HY		0.595	0.595			0.00986	0.195	0.00745	0.23	0.0512	0.0283	0.0232	0.0499	
28		2502-HY														
29		2502-HY														
30		2502-HY														
31		2502-HY														
32		2502-HY														
33		2502-HY														
34	A	2502-HY		0.889	0.889	8.36	8.36	0.0125	0.293	0.00786	0.368	0.0605	0.0431	0.0294	0.0744	7.47
35		2502-HY														
36		2502-HY														
37		2502-HY														
38		2502-HY														
39	A	2502-HY		0.675	0.675	10	10	0.0106	0.221	0.00589	0.274	0.0524	0.0346	0.0218	0.0542	9.37
40		2502-HY														
41		2502-HY														
42		2502-HY														
43		2502-HY														
44	A	2502-HY		0.619	0.619	8.75	8.75	0.0105	0.218	0.00722	0.226	0.0531	0.03	0.0211	0.0526	8.13
45	A	2502-HY		0.63	0.63	7.2	7.2	0.0097	0.205	0.0081	0.24	0.0547	0.0321	0.0212	0.0597	6.57
46		2502-HY														
47		2502-HY														
48		2502-HY														
49		2502-HY														
50		2502-HY														
51		2502-HY														
52		2502-HY														
53		2502-HY														
54	A	2502-HY		0.772	0.772	12	12	0.011	0.232	0.00739	0.257	0.0536	0.0634	0.0344	0.113	11.2
55		2502-HY														
56		2502-HY														
57		2502-HY														
58		2502-HY														
59		2502-HY														
60	A	2502-HY		0.672	0.672	9.83	9.83	0.0109	0.227	0.00678	0.263	0.0557	0.0343	0.0234	0.05	9.16
61		2502-HY														
62		2502-HY														
63		2502-HY														
64	A	2502-HY		0.581	0.581			0.00919	0.185	0.00348	0.218	0.0823	0.0287	0.0192	0.0345	
65		2502-HY														
66		2502-HY														
67		2502-HY														
68	A	2502-HY		0.55	0.54	12.7	12.7	0.0093	0.158	<0.01	0.22	0.0482	0.0314	0.0201	0.0524	12.1
69		2502-HY														

Hay (2502-HY)

PBDE - Results

LC	Data set	Sample	Result µg/kg 12% moisture content	Sum of 8 PBDE without BDE-209 (ub)	Sum of 8 PBDE without BDE-209 (lb)	Sum of 9 PBDE including BDE-209 (ub)	Sum of 9 PBDE including BDE-209 (lb)	2,2',4'- tribromodiphenyl ether BDE-28	2,2',4,4'- tetrabromodiphenyl ether BDE-47	2,2',4,5'- tetrabromodiphenyl ether BDE-49	2,2',4,4',5'- pentabromodiphenyl ether BDE-99	2,2',4,4',6'- pentabromodiphenyl ether BDE-100	2,2',4,4',5,5'- hexabromodiphenyl ether BDE-153	2,2',4,4',5,6'- hexabromodiphenyl ether BDE-154	2,2',3,4,4',5',6'- heptabromodiphenyl ether BDE-183	2,2',3,3',4,4',5,5',6,6'- decabromodiphenyl ether BDE-209
70		2502-HY														
71		2502-HY														
72	A	2502-HY						0.0109	0.235		0.282	0.0559	0.0343	0.0244	0.0583	
73		2502-HY														
74		2502-HY														
75		2502-HY														
76		2502-HY														
77		2502-HY														
78	A	2502-HY		0.645	0.645	9.7	9.7	0.0104	0.216	0.0061	0.248	0.052	0.0328	0.0226	0.0577	9.05
79	A	2502-HY		0.476	0.476	3.52	3.52	0.0078	0.157	0.0057	0.188	0.039	0.0239	0.0168	0.0378	3.05
80	A	2502-HY		0.69	0.69	7.5	7.5	0.012	0.24	0.0085	0.26	0.051	0.04	0.026	0.051	6.8
81		2502-HY														
82	A	2502-HY		0.57	0.57			0.0085	0.199	0.0015	0.217	0.0481	0.0312	0.0198	0.0487	
83		2502-HY														
84		2502-HY														
85		2502-HY														
86	A	2502-HY		0.409	0.369	4.68	4.64	<0.02	0.124	<0.02	0.128	0.036	0.025	0.023	0.034	4.27
87		2502-HY														
88		2502-HY														
89	A	2502-HY		0.907	0.907	4.75	4.75	0.0261	0.38	0.0157	0.266	0.0811	0.0373	0.0273	0.0738	3.84
90		2502-HY														
91		2502-HY														
92		2502-HY														
93		2502-HY														
94		2502-HY														
95	A	2502-HY		0.637	0.637	9.67	9.67	0.0127	0.214	0.00584	0.24	0.0509	0.0331	0.0215	0.0587	9.03
96		2502-HY														
97		2502-HY														
Additional Sets																
16	B	2502-HY		0.666	0.666	11.1	11.1	0.013	0.229	0.00986	0.246	0.0561	0.0334	0.0229	0.0554	10.4
86	B	2502-HY		0.588	0.548	7.34	7.3	<0.02	0.173	<0.02	0.201	0.054	0.036	0.029	0.055	6.75

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Moisture content (PBDE) - Results

LC	Data set	Sample	Result %	Moisture content PBDE
1		2502-HY		
2		2502-HY		
3		2502-HY		
4		2502-HY		
5		2502-HY		
6		2502-HY		
7	A	2502-HY		10.2
8		2502-HY		
9	A	2502-HY		91.6
10		2502-HY		
11	A	2502-HY		91.3
12		2502-HY		
13		2502-HY		
14		2502-HY		
15	A	2502-HY		
16	A	2502-HY		8.28
17		2502-HY		
18	A	2502-HY		7.98
19		2502-HY		
20		2502-HY		
21		2502-HY		
22		2502-HY		
23		2502-HY		
24		2502-HY		
25		2502-HY		
26	A	2502-HY		7.9
27	A	2502-HY		8.21
28		2502-HY		
29		2502-HY		
30		2502-HY		
31		2502-HY		
32		2502-HY		
33		2502-HY		
34	A	2502-HY		9.6
35		2502-HY		
36		2502-HY		
37		2502-HY		
38		2502-HY		
39	A	2502-HY		8.41
40		2502-HY		
41		2502-HY		
42		2502-HY		
43		2502-HY		
44	A	2502-HY		7.67
45	A	2502-HY		92
46		2502-HY		
47		2502-HY		
48		2502-HY		
49		2502-HY		
50		2502-HY		
51		2502-HY		
52		2502-HY		
53		2502-HY		
54	A	2502-HY		9.5
55		2502-HY		
56		2502-HY		
57		2502-HY		

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Moisture content (PBDE) - Results

LC	Data set	Sample	Result %	Moisture content PBDE
58		2502-HY		
59		2502-HY		
60	A	2502-HY		7.34
61		2502-HY		
62		2502-HY		
63		2502-HY		
64	A	2502-HY		
65		2502-HY		
66		2502-HY		
67		2502-HY		
68	A	2502-HY		8.25
69		2502-HY		
70		2502-HY		
71		2502-HY		
72	A	2502-HY		8.6
73		2502-HY		
74		2502-HY		
75		2502-HY		
76		2502-HY		
77		2502-HY		
78	A	2502-HY		8.65
79	A	2502-HY		8.5
80	A	2502-HY		8.61
81		2502-HY		
82	A	2502-HY		9
83		2502-HY		
84		2502-HY		
85		2502-HY		
86	A	2502-HY		8
87		2502-HY		
88		2502-HY		
89	A	2502-HY		7.52
90		2502-HY		
91		2502-HY		
92		2502-HY		
93		2502-HY		
94		2502-HY		
95	A	2502-HY		90.2
96		2502-HY		
97		2502-HY		
Additional Sets				
16	B	2502-HY		8.28
86	B	2502-HY		8



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 3: Participants' z-scores of PBDEs - Tables

Test sample - Hay (2502-HY)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value

$$z = (x - x_a) / (\sigma_{\text{prel}} * x_a)$$

x_a : assigned value

x : participant's result

σ_{prel} : fitness-for-purpose-based standard deviation for proficiency assessment

20%: Evaluated individual PBDE congeners and sum parameters

Hay (2502-HY)

PBDE- Z-scores

LC	Data set	Sample	Z-score [σ _p = 20 %]	Sum of 8 PBDE without BDE-209 (ub)	Sum of 8 PBDE without BDE-209 (lb)	Sum of 9 PBDE including BDE-209 (ub)	Sum of 9 PBDE including BDE-209 (lb)	Z-score [σ _p = 20 %]	2,2',4'- tribromodiphenyl ether BDE-28	2,2',4,4'- tetrabromodiphenyl ether BDE-47	2,2',4,5'- tetrabromodiphenyl ether BDE-49	2,2',4,4',5'- pentabromodiphenyl ether BDE-99	2,2',4,4',6'- pentabromodiphenyl ether BDE-100	2,2',4,4',5,5'- hexabromodiphenyl ether BDE-153	2,2',4,4',5,6'- hexabromodiphenyl ether BDE-154	2,2',3,4,4',5',6'- heptabromodiphenyl ether BDE-183	2,2',3,3',4,4',5,5',6,6'- decabromodiphenyl ether BDE-209
1		2502-HY															
2		2502-HY															
3		2502-HY															
4		2502-HY															
5		2502-HY															
6		2502-HY															
7	A	2502-HY		0.2	0.2	-0.3	-0.3		0.2	-0.1	-0.5	0.7	0.2	-0.3	-0.5	-0.2	-0.4
8		2502-HY															
9	A	2502-HY		0.0	0.0	-0.4	-0.4		1.1	-0.1	-0.2	-0.1	0.2	0.1	-0.1	0.3	-0.4
10		2502-HY															
11	A	2502-HY		0.0	0.0	0.1	0.1		0.5	-0.4	-2.0	0.2	0.4	-0.2	0.0	0.7	0.1
12		2502-HY															
13		2502-HY															
14		2502-HY															
15	A	2502-HY		-1.7	-1.7	-0.3	-0.3		-0.2	0.0	0.3	0.0	0.0	0.4	0.2	-0.2	-0.3
16	A	2502-HY		0.1	0.1	1.8	1.8		-0.2	0.5	0.1	-0.1	0.0	0.1	0.3	-0.2	2.0
17		2502-HY															
18	A	2502-HY		0.1	0.1	-0.3	-0.3		0.2	0.5	-0.8	0.0	-0.3	0.0	-0.2	-0.3	-0.3
19		2502-HY															
20		2502-HY															
21		2502-HY															
22		2502-HY															
23		2502-HY															
24		2502-HY															
25		2502-HY															
26	A	2502-HY		-0.3	-0.3	-1.3	-1.3		-0.8	-0.2	-0.2	-0.4	-0.2	-0.3	-0.6	-0.4	-1.4
27	A	2502-HY		-0.2	-0.2				-0.3	-0.4	0.6	-0.2	-0.1	-0.6	0.3	-0.3	
28		2502-HY															
29		2502-HY															
30		2502-HY															
31		2502-HY															
32		2502-HY															
33		2502-HY															
34	A	2502-HY		2.1	2.1	0.2	0.2		1.0	2.0	0.9	2.6	0.8	1.7	1.7	2.0	0.1
35		2502-HY															
36		2502-HY															
37		2502-HY															
38		2502-HY															
39	A	2502-HY		0.4	0.4	1.2	1.2		0.0	0.3	-0.6	0.7	0.0	0.4	0.0	0.1	1.4
40		2502-HY															
41		2502-HY															
42		2502-HY															
43		2502-HY															
44	A	2502-HY		0.0	0.0	0.5	0.5		0.0	0.2	0.4	-0.3	0.1	-0.3	-0.2	0.0	0.5
45	A	2502-HY		0.0	0.0	-0.5	-0.5		-0.4	-0.1	1.1	0.0	0.3	0.0	-0.2	0.7	-0.5
46		2502-HY															
47		2502-HY															
48		2502-HY															
49		2502-HY															
50		2502-HY															
51		2502-HY															
52		2502-HY															
53		2502-HY															
54	A	2502-HY		1.2	1.2	2.5	2.5		0.2	0.5	0.6	0.3	0.2	4.8	2.8	5.7	2.6
55		2502-HY															
56		2502-HY															
57		2502-HY															
58		2502-HY															
59		2502-HY															
60	A	2502-HY		0.4	0.4	1.1	1.1		0.2	0.4	0.1	0.5	0.4	0.3	0.3	-0.3	1.2
61		2502-HY															
62		2502-HY															
63		2502-HY															
64	A	2502-HY		-0.4	-0.4				-0.6	-0.6	-2.4	-0.5	2.9	-0.5	-0.6	-1.7	
65		2502-HY															
66		2502-HY															
67		2502-HY															
68	A	2502-HY		-0.6	-0.7	2.9	2.9		-0.6	-1.2		-0.4	-0.4	-0.1	-0.4	0.0	3.2
69		2502-HY															
70		2502-HY															
71		2502-HY															
72	A	2502-HY							0.2	0.6		0.9	0.4	0.3	0.5	0.5	
73		2502-HY															
74		2502-HY															

Hay (2502-HY)
 PBDE- Z-scores

LC	Data set	Sample	Z-score [σ _p = 20 %]	Sum of 8 PBDE without BDE-209 (ub)	Sum of 8 PBDE without BDE-209 (lb)	Sum of 9 PBDE including BDE-209 (ub)	Sum of 9 PBDE including BDE-209 (lb)	Z-score [σ _p = 20 %]	2,2',4'- tribromodiphenyl ether BDE-28	2,2',4,4'- tetrabromodiphenyl ether BDE-47	2,2',4,5'- tetrabromodiphenyl ether BDE-49	2,2',4,4',5'- pentabromodiphenyl ether BDE-99	2,2',4,4',6'- pentabromodiphenyl ether BDE-100	2,2',4,4',5,5'- hexabromodiphenyl ether BDE-153	2,2',4,4',5,6'- hexabromodiphenyl ether BDE-154	2,2',3,4,4',5',6'- heptabromodiphenyl ether BDE-183	2,2',3,3',4,4',5,5',6,6'- decabromodiphenyl ether BDE-209
75		2502-HY															
76		2502-HY															
77		2502-HY															
78	A	2502-HY		0.2	0.2	1.1	1.1		0.0	0.1	-0.4	0.1	0.0	0.1	0.1	0.5	1.1
79	A	2502-HY		-1.2	-1.2	-2.8	-2.8		-1.3	-1.3	-0.7	-1.1	-1.3	-1.3	-1.2	-1.4	-2.9
80	A	2502-HY		0.5	0.5	-0.3	-0.3		0.7	0.7	1.4	0.4	-0.1	1.2	0.9	-0.2	-0.4
81		2502-HY															
82	A	2502-HY		-0.4	-0.4				-1.0	-0.3	-3.9	-0.5	-0.4	-0.2	-0.5	-0.4	
83		2502-HY															
84		2502-HY															
85		2502-HY															
86	A	2502-HY		-1.7	-2.0	-2.1	-2.1			-2.0		-2.3	-1.5	-1.1	0.2	-1.8	-2.1
87		2502-HY															
88		2502-HY															
89	A	2502-HY		2.3	2.3	-2.0	-2.0		7.4	4.0	6.8	0.5	2.8	0.8	1.2	2.0	-2.4
90		2502-HY															
91		2502-HY															
92		2502-HY															
93		2502-HY															
94		2502-HY															
95	A	2502-HY		0.1	0.1	1.0	1.0		1.0	0.1	-0.6	0.0	-0.1	0.1	-0.1	0.6	1.1
96		2502-HY															
97		2502-HY															
Additional Sets																	
16	B	2502-HY		0.3	0.3	1.9	1.9		1.2	0.5	2.4	0.1	0.4	0.2	0.2	0.2	2.1
86	B	2502-HY		-0.3	-0.6	-0.4	-0.4			-0.9		-0.8	0.2	0.6	1.6	0.2	-0.4



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)

Moisture content (PBDE) - Z-scores

LC	Data set	Sample	Z-score [$\sigma_p = 10\%$]	Moisture content PBDE
1		2502-HY		
2		2502-HY		
3		2502-HY		
4		2502-HY		
5		2502-HY		
6		2502-HY		
7	A	2502-HY		2.2
8		2502-HY		
9	A	2502-HY		99.8
10		2502-HY		
11	A	2502-HY		99.5
12		2502-HY		
13		2502-HY		
14		2502-HY		
15	A	2502-HY		
16	A	2502-HY		-0.1
17		2502-HY		
18	A	2502-HY		-0.4
19		2502-HY		
20		2502-HY		
21		2502-HY		
22		2502-HY		
23		2502-HY		
24		2502-HY		
25		2502-HY		
26	A	2502-HY		-0.5
27	A	2502-HY		-0.2
28		2502-HY		
29		2502-HY		
30		2502-HY		
31		2502-HY		
32		2502-HY		
33		2502-HY		
34	A	2502-HY		1.5
35		2502-HY		
36		2502-HY		
37		2502-HY		
38		2502-HY		
39	A	2502-HY		0.1
40		2502-HY		
41		2502-HY		
42		2502-HY		
43		2502-HY		
44	A	2502-HY		-0.8
45	A	2502-HY		100.3
46		2502-HY		
47		2502-HY		
48		2502-HY		
49		2502-HY		
50		2502-HY		
51		2502-HY		
52		2502-HY		
53		2502-HY		
54	A	2502-HY		1.4
55		2502-HY		
56		2502-HY		
57		2502-HY		



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)

Moisture content (PBDE) - Z-scores

LC	Data set	Sample	Z-score [$\sigma_p = 10\%$]	Moisture content PBDE
58		2502-HY		
59		2502-HY		
60	A	2502-HY		-1.2
61		2502-HY		
62		2502-HY		
63		2502-HY		
64	A	2502-HY		
65		2502-HY		
66		2502-HY		
67		2502-HY		
68	A	2502-HY		-0.1
69		2502-HY		
70		2502-HY		
71		2502-HY		
72	A	2502-HY		0.3
73		2502-HY		
74		2502-HY		
75		2502-HY		
76		2502-HY		
77		2502-HY		
78	A	2502-HY		0.4
79	A	2502-HY		0.2
80	A	2502-HY		0.3
81		2502-HY		
82	A	2502-HY		0.8
83		2502-HY		
84		2502-HY		
85		2502-HY		
86	A	2502-HY		-0.4
87		2502-HY		
88		2502-HY		
89	A	2502-HY		-1.0
90		2502-HY		
91		2502-HY		
92		2502-HY		
93		2502-HY		
94		2502-HY		
95	A	2502-HY		98.2
96		2502-HY		
97		2502-HY		
Additional Sets				
16	B	2502-HY		-0.1
86	B	2502-HY		-0.4



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 4 : Participants' z-scores of PBDEs - Charts

Test sample - Hay (2502-HY)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value


$$z = (x - x_a) / (\sigma_{\text{prel}} * x_a)$$


x_a : assigned value

x : participant's result

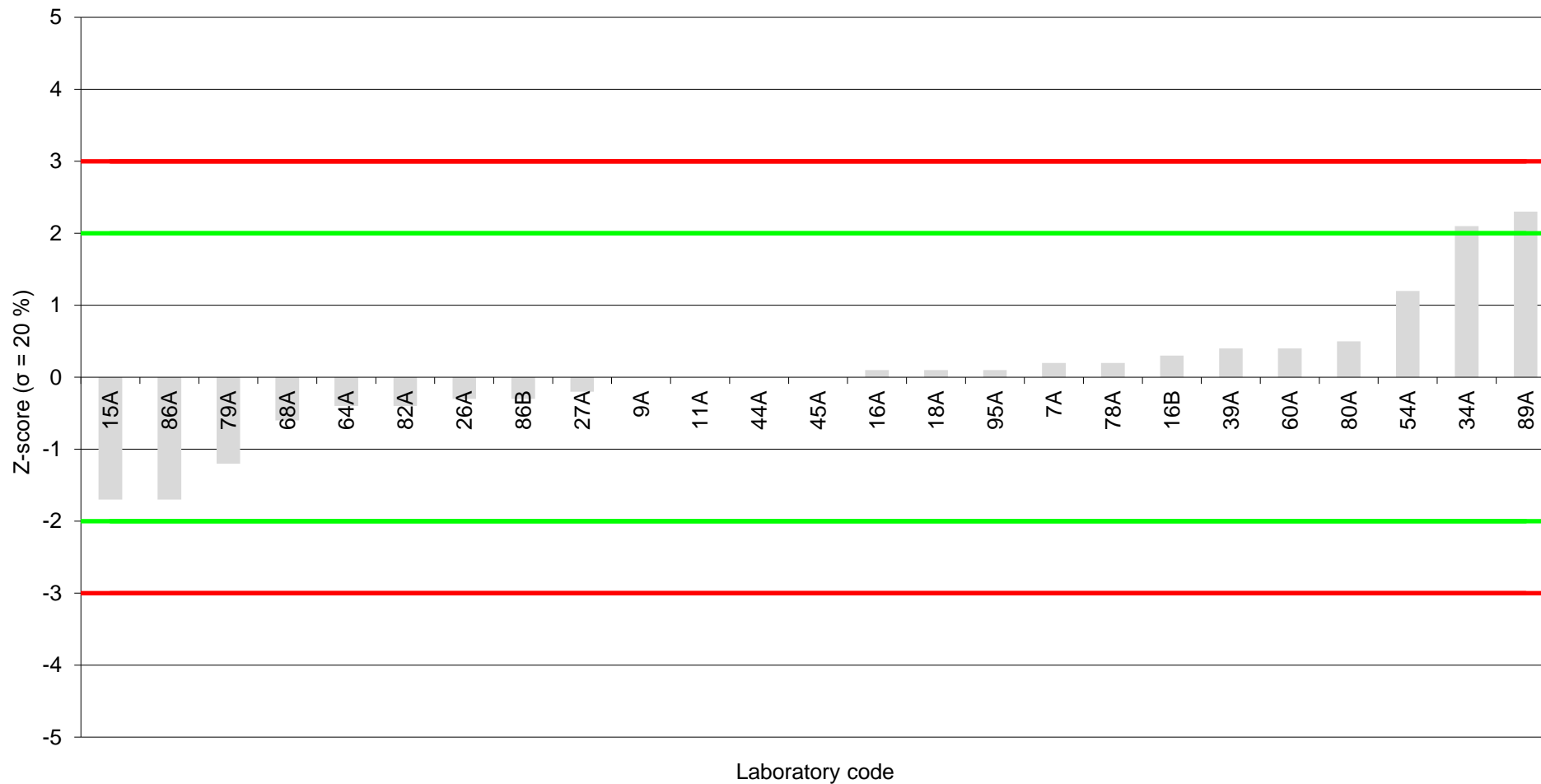
σ_{prel} : fitness-for-purpose-based standard deviation for proficiency assessment

20%: Evaluated individual PBDE congeners and sum parameters

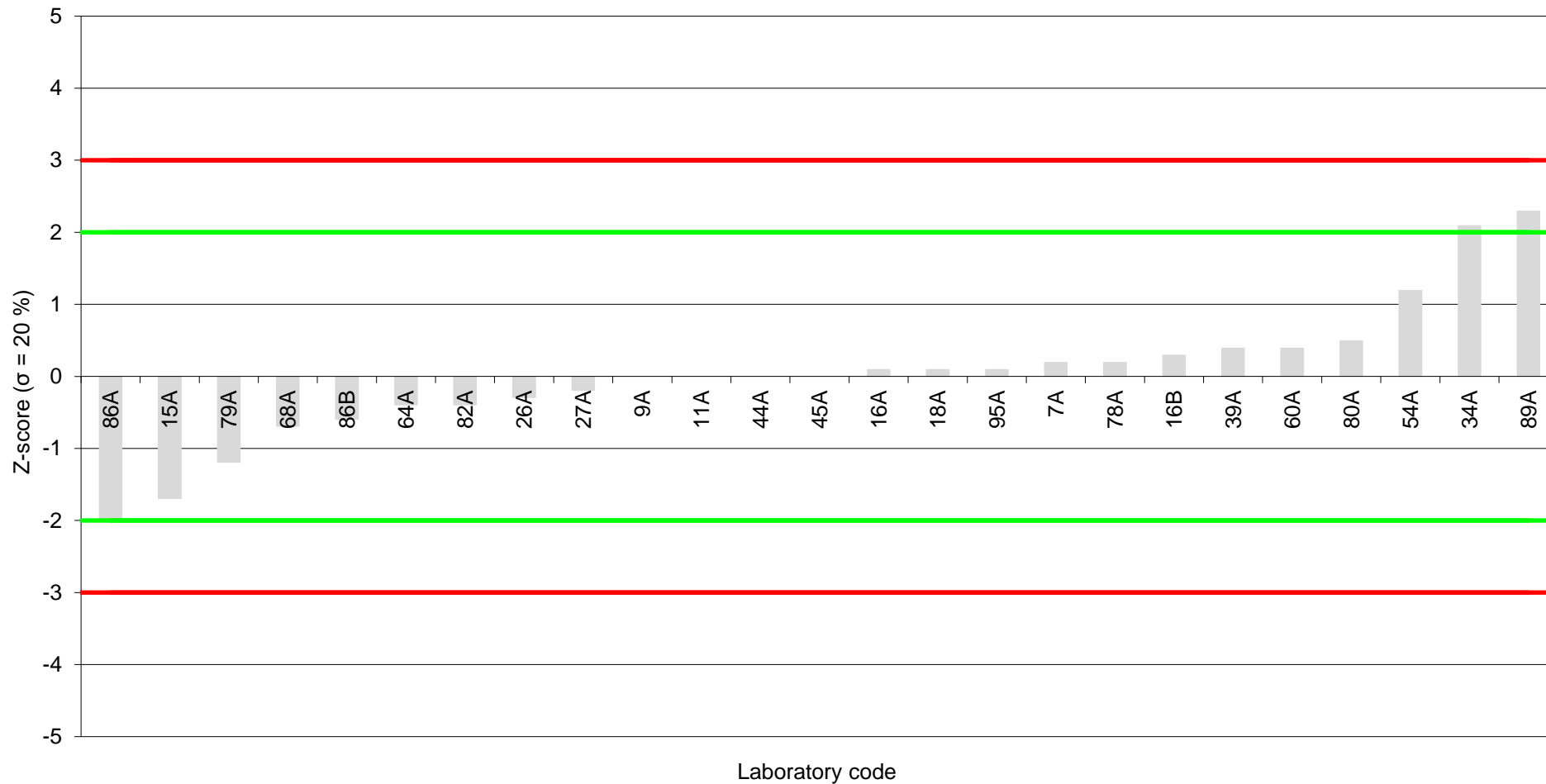
± 2 z-scores: 

± 3 z-scores: 

Hay (2502-HY)
Sum of 8 PBDE without BDE-209 ub
Assigned value: 0.625 µg/kg product (12 % moisture content)



Hay (2502-HY)
Sum of 8 PBDE without BDE-209 lb
Assigned value: 0.625 µg/kg product (12 % moisture content)



Hay (2502-HY)
Sum of 9 PBDE including BDE-209 ub
Assigned value: 8.01 µg/kg product (12 % moisture content)



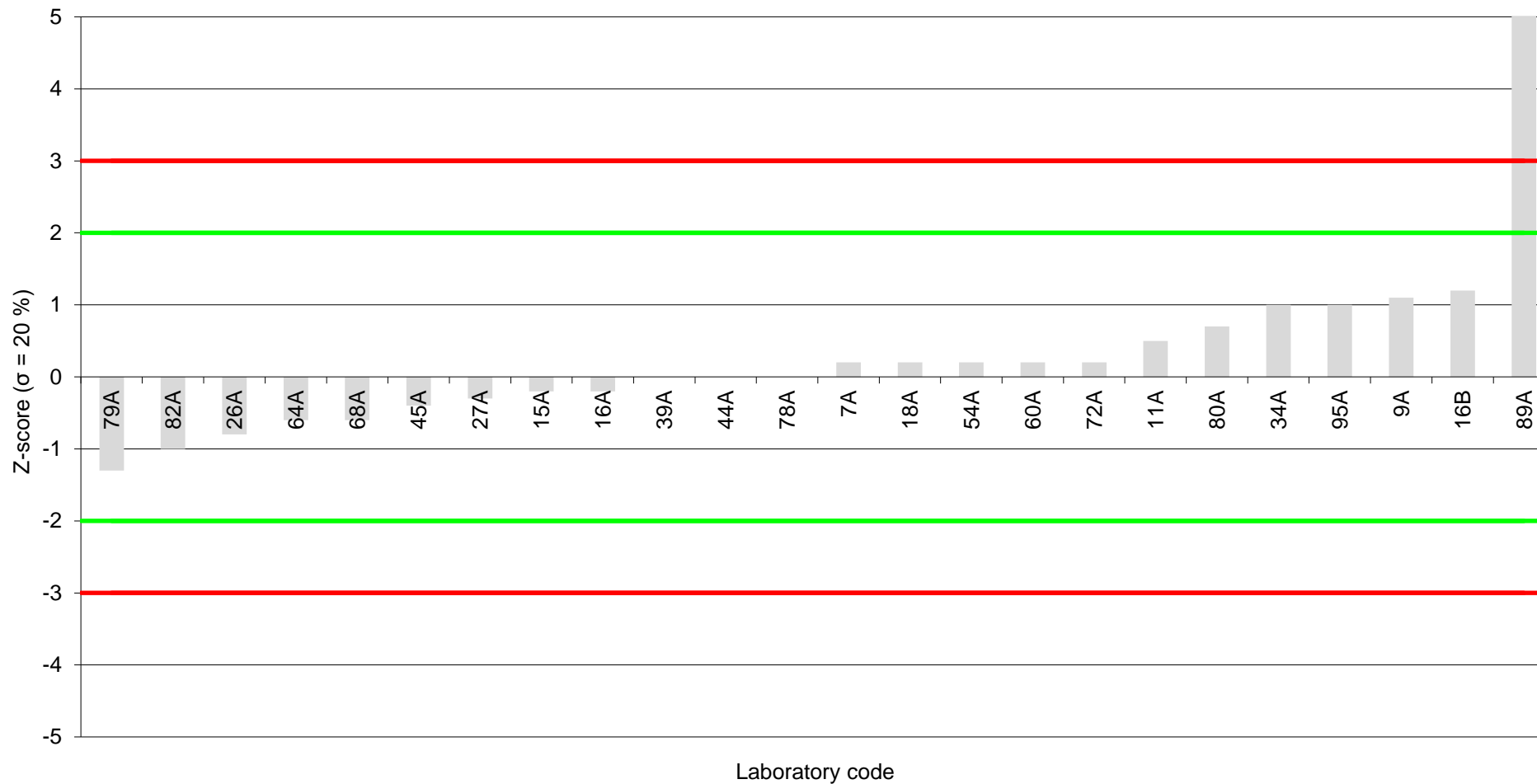
Hay (2502-HY)
Sum of 9 PBDE including BDE-209 lb
Assigned value: 8.01 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-28

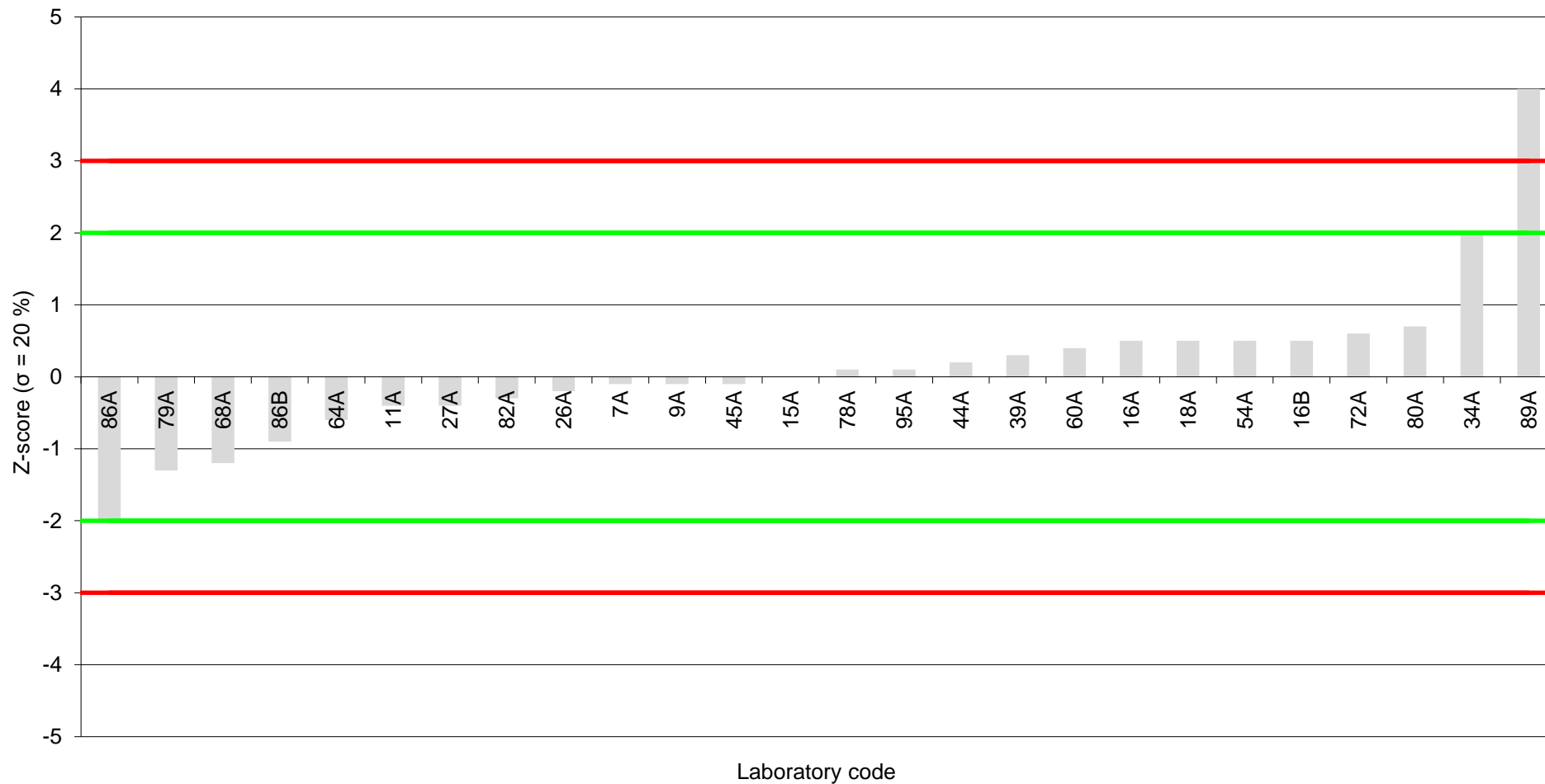
Assigned value: 0.0105 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-47

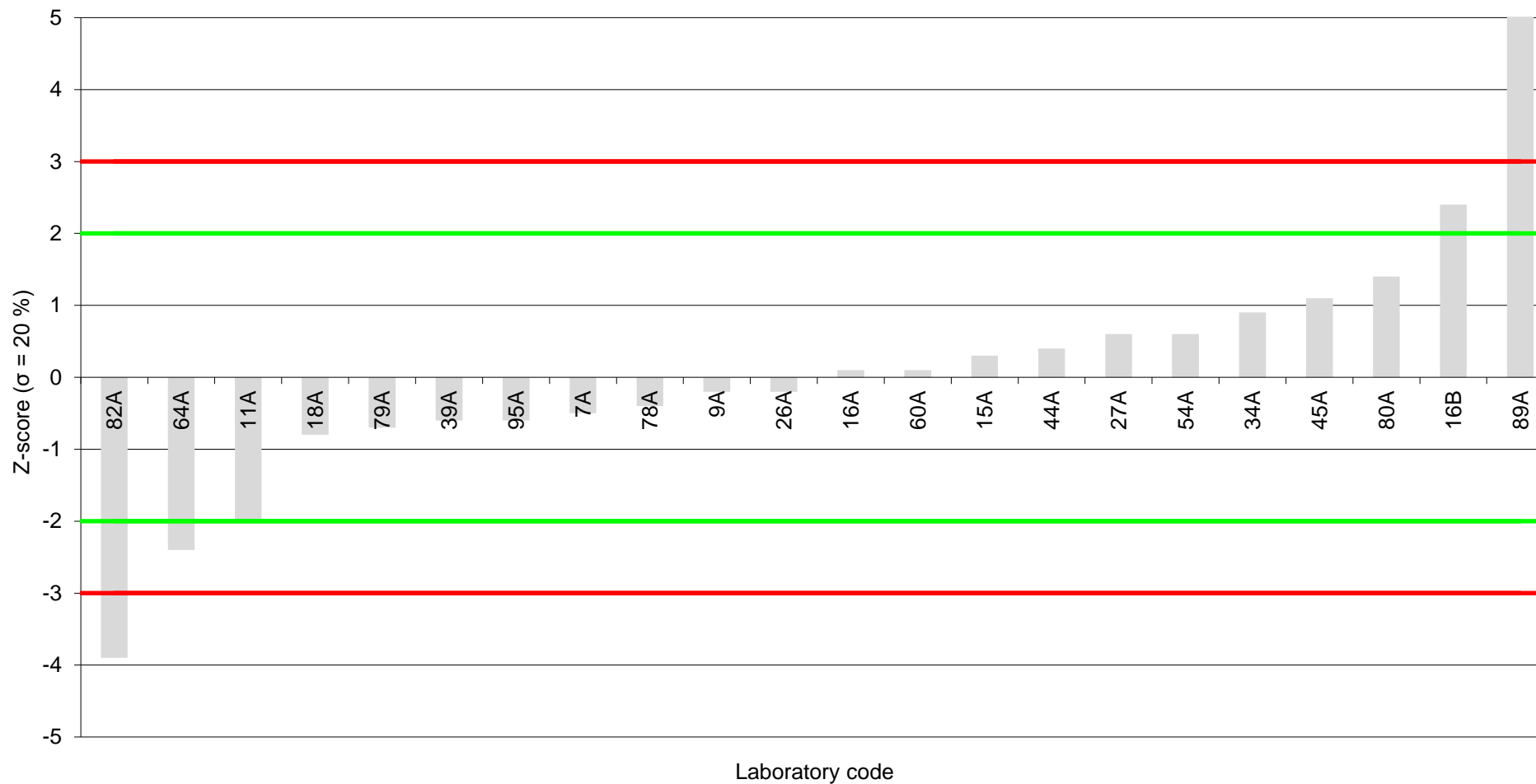
Assigned value: 0.21 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-49

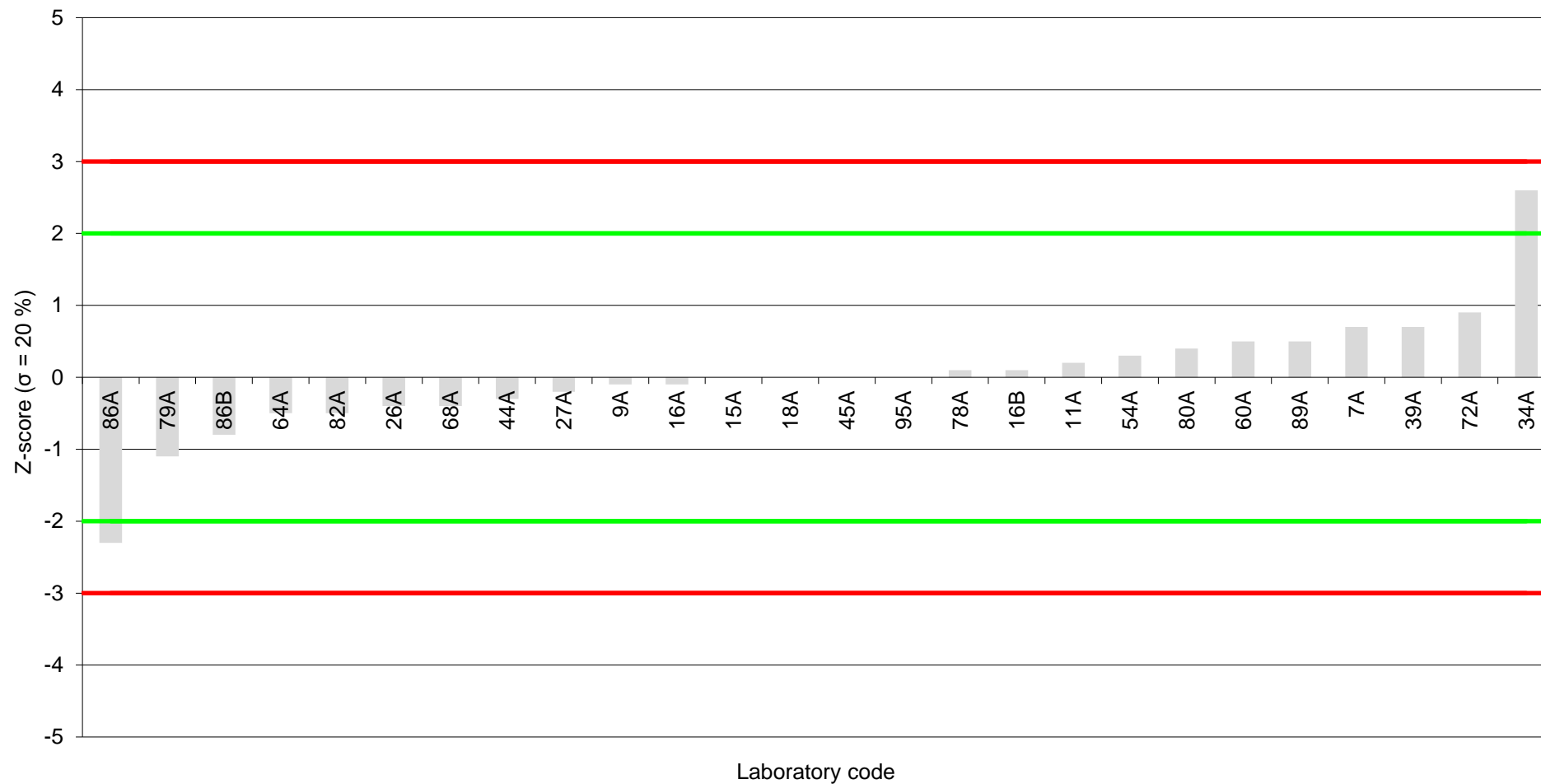
Assigned value: 0.00664 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-99

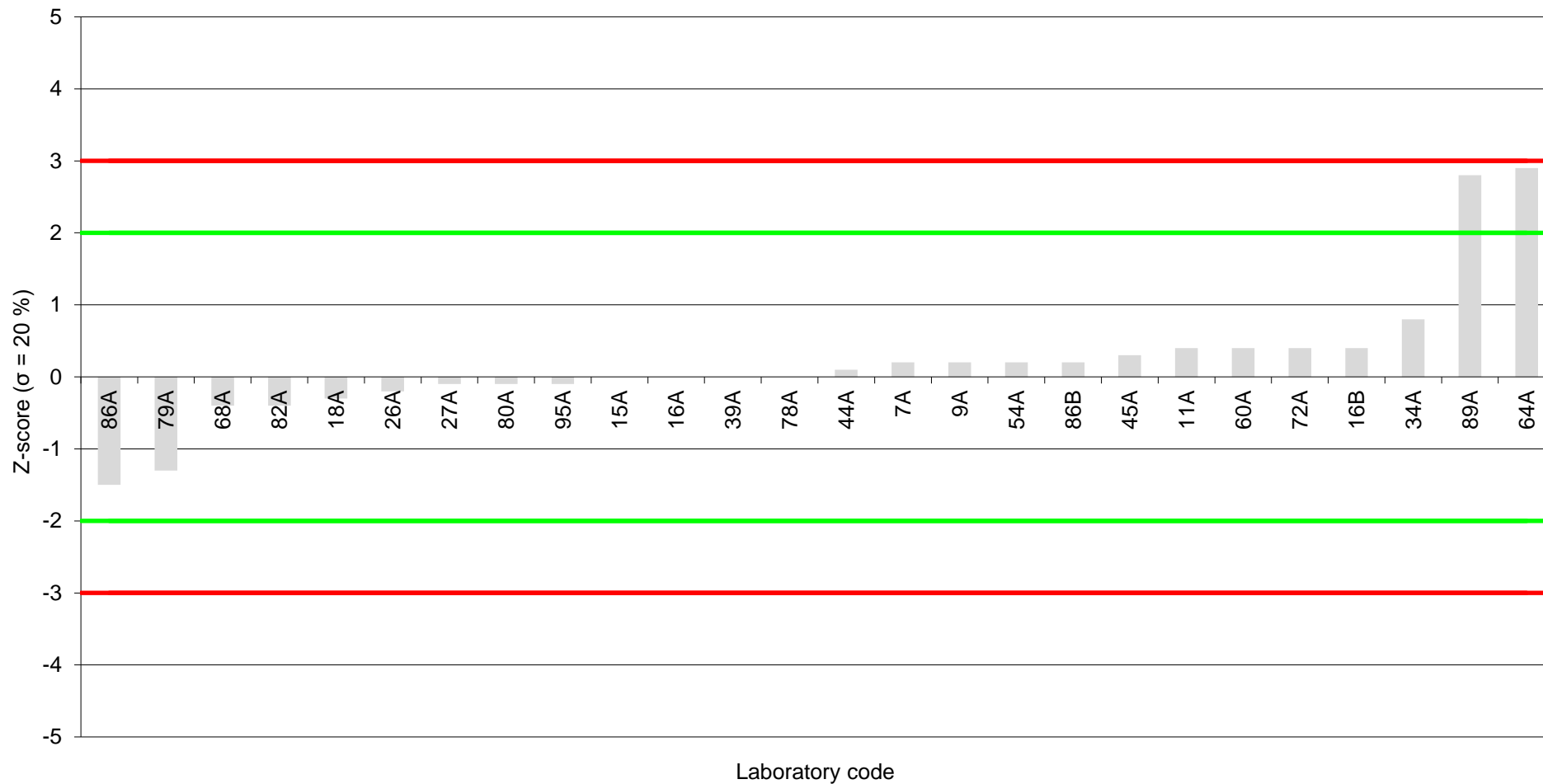
Assigned value: 0.241 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-100

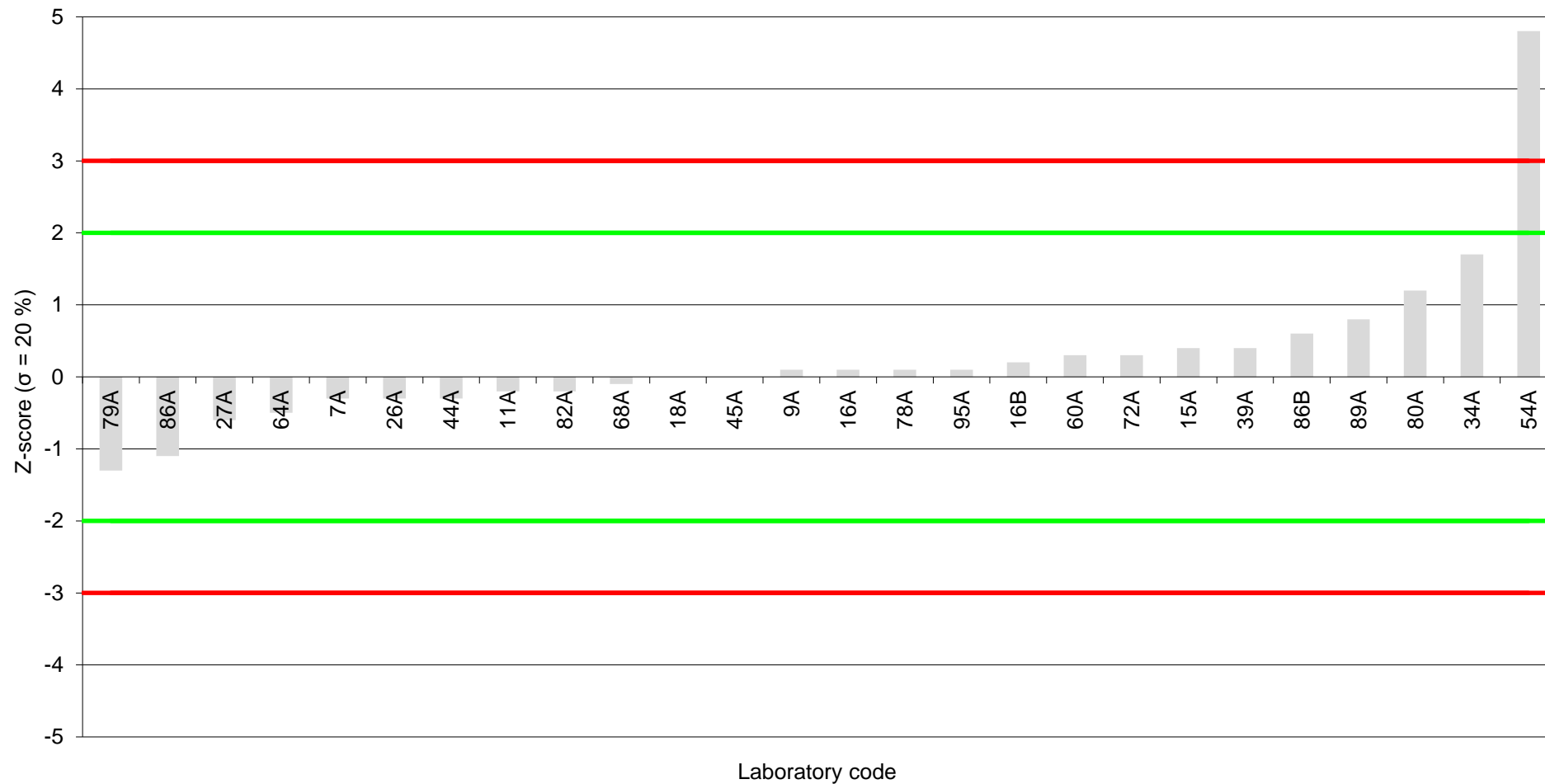
Assigned value: 0.052 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-153

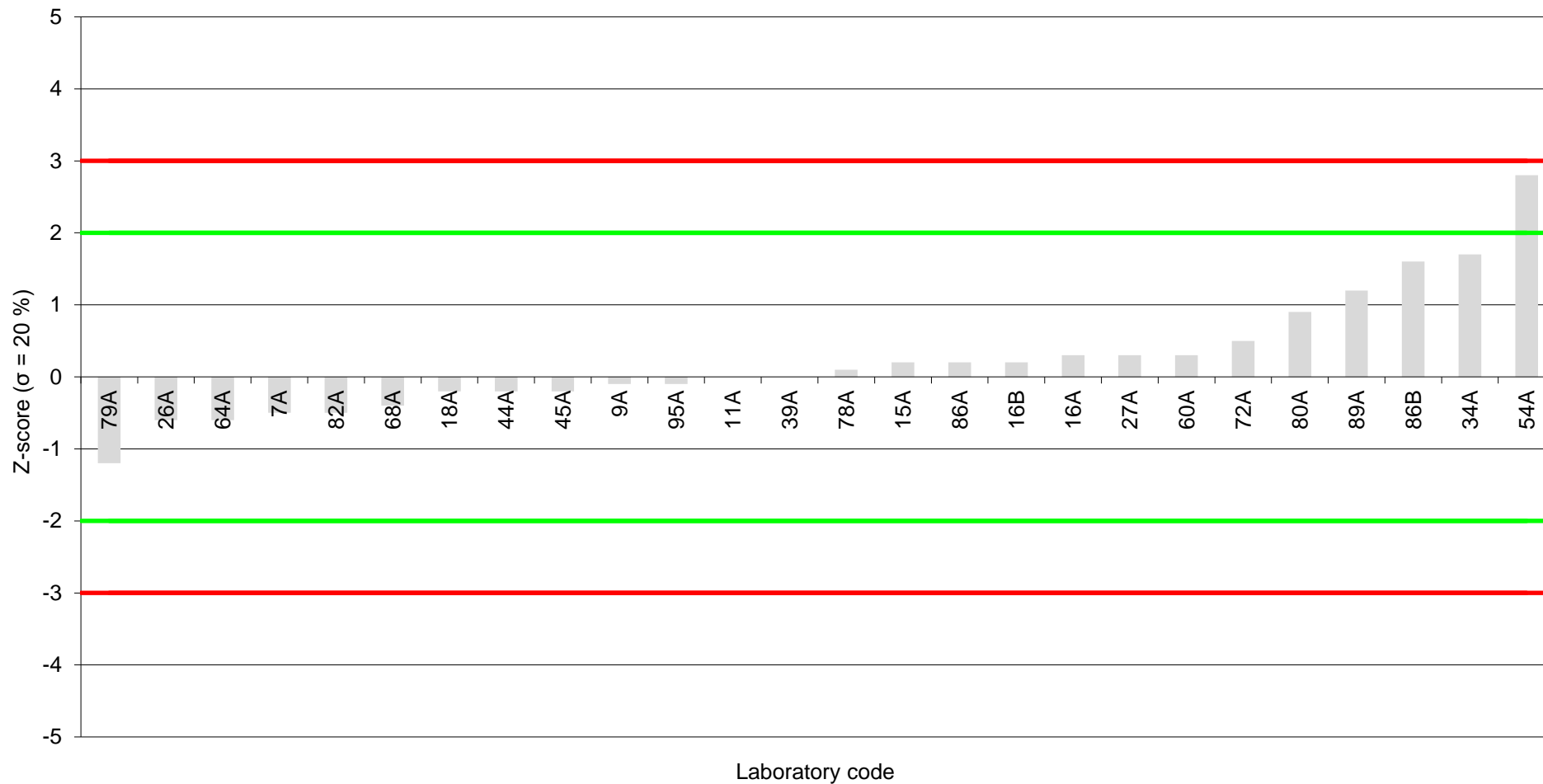
Assigned value: 0.0322 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-154

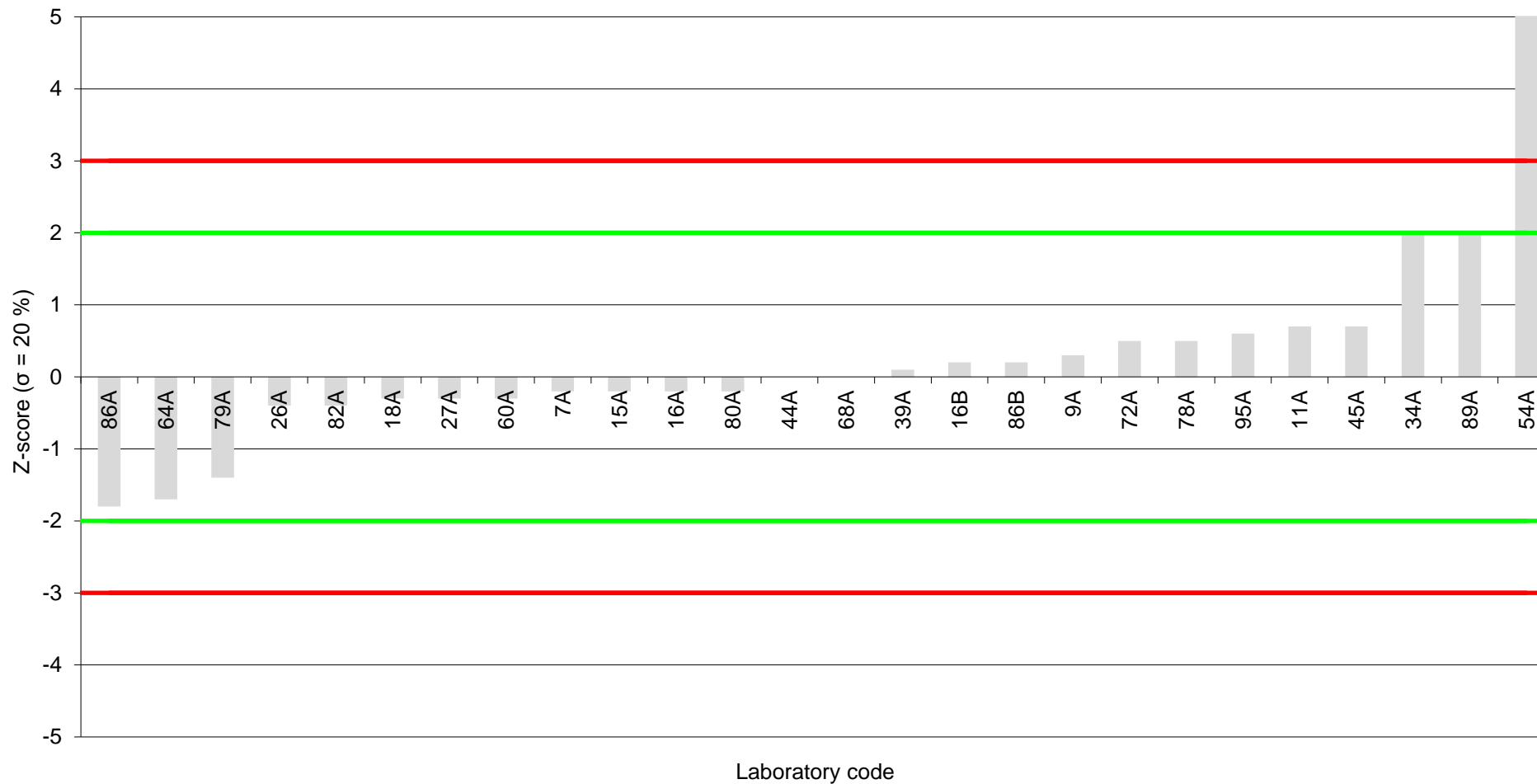
Assigned value: 0.022 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-183

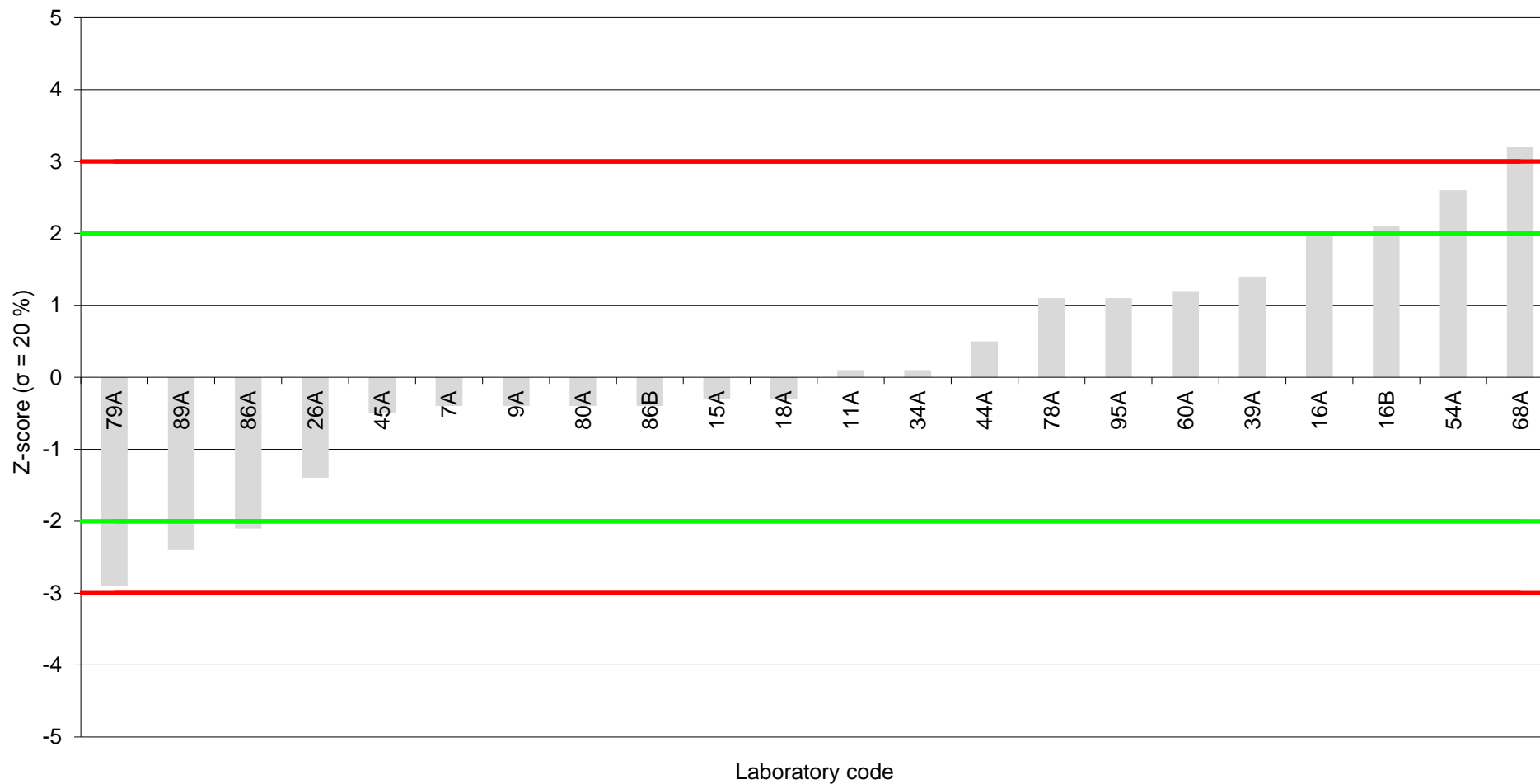
Assigned value: 0.0528 µg/kg product (12 % moisture content)



Hay (2502-HY)

BDE-209

Assigned value: 7.36 µg/kg product (12 % moisture content)





EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 5: Test for sufficient homogeneity and stability for PBDEs

Test sample - Hay (2502-HY)



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

PBDE - Homogeneity test - Data

Analyte	Result µg/kg 12% moisture content	Mean (n = 10, duplicate analysis)	Median (n = 10, duplicate analysis)	Relative standard deviation [%]
Sum of 8 PBDE - without BDE-209 (lb)		0.578	0.574	3%
Sum of 8 PBDE - without BDE-209 (ub)		0.578	0.574	3%
Sum of 9 PBDE - including BDE-209 (lb)		8.07	7.92	11%
Sum of 9 PBDE - including BDE-209 (ub)		8.07	7.92	11%
BDE-28		0.00951	0.00953	1%
BDE-47		0.176	0.177	4%
BDE-49		0.0119	0.0113	10%
BDE-99		0.231	0.229	4%
BDE-100		0.0500	0.0494	3%
BDE-153		0.0320	0.0317	4%
BDE-154		0.0217	0.0215	4%
BDE-183		0.0457	0.0448	9%
BDE-209		7.50	7.34	12%

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Selected PBDE congener - Homogeneity test - Data

Sample	Replicate	Result µg/kg 12% moisture content	BDE-153
6	1		0.0323
	2		0.0297
9	1		0.0349
	2		0.0319
69	1		0.0311
	2		0.0310
71	1		0.0315
	2		0.0315
85	1		0.0309
	2		0.0324
111	1		0.0304
	2		0.0320
136	1		0.0314
	2		0.0344
152	1		0.0321
	2		0.0333
181	1		0.0310
	2		0.0316
185	1		0.0333
	2		0.0332
Cochran's C-test			
C			0.305
C _{critical} (α = 0.05, m = 2, n = 10)			0.602
C _{critical} (α = 0.01, m = 2, n = 10)			0.718
C < C _{critical}			yes
Outliers			no evidence for analytical outliers
Homogeneity test			
General average \bar{x}			0.0320
Standard deviation of sample averages s_x			0.0010
Within-sample standard deviation s_w			0.0012
Between-sample standard deviation s_s			0.000374
Standard deviation for proficiency assessment σ_{PT}			0.0064
s_s / σ_{PT}			0.100
Test for homogeneity ($s_s \leq 0.3 \sigma_{PT}$)			passed



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Selected PBDE congener - Stability test - Data

Sample	Replicate	Result µg/kg 12% moisture content	BDE-153	
33	1		0.0313	
	2		0.0312	
150	1		0.0315	
	2		0.0337	
85	1		0.0246	
	2		0.0329	
Stability test				
General average (stability test) \bar{y}			0.0309	
General average (homogeneity test) \bar{x}			0.0320	
Standard deviation for proficiency assessment σ_{PT}			0.0064	
$ \bar{y} - \bar{x} $			0.00113	
Test for stability ($ \bar{y} - \bar{x} \leq 0.3 \sigma_{PT}$)			passed	



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 6: Participants' methods for PBDEs

Test sample - Hay (2502-HY)

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

Hay (2502-HY)

Methods PBDEs - Accreditation, weighed sample, standards

LC	Data set	Sample	Accreditation according to ISO/IEC 17025	Weighed sample [g]	Use of isotope-labelled internal standards for PBDE congeners (yes/no)
1		2502-HY			
2		2502-HY			
3		2502-HY			
4		2502-HY			
5		2502-HY			
6		2502-HY			
7	A	2502-HY	yes	10	yes
8		2502-HY			
9	A	2502-HY	yes	5	yes
10		2502-HY			
11	A	2502-HY	yes	10	yes
12		2502-HY			
13		2502-HY			
14		2502-HY			
15		2502-HY			
16	A	2502-HY	yes	10	yes
17		2502-HY			
18	A	2502-HY	yes	10	yes
19		2502-HY			
20		2502-HY			
21		2502-HY			
22		2502-HY			
23		2502-HY			
24		2502-HY			
25		2502-HY			
26	A	2502-HY	yes	3	yes
27	A	2502-HY	yes	20	yes
28		2502-HY			
29		2502-HY			
30		2502-HY			
31		2502-HY			
32		2502-HY			
33		2502-HY			
34	A	2502-HY	yes	20	yes
35		2502-HY			
36		2502-HY			
37		2502-HY			
38		2502-HY			
39	A	2502-HY	yes	25.8739	yes
40		2502-HY			
41		2502-HY			
42		2502-HY			
43		2502-HY			
44	A	2502-HY	no	10	yes
45	A	2502-HY	yes	5.05	yes
46		2502-HY			
47		2502-HY			
48		2502-HY			
49		2502-HY			
50		2502-HY			
51		2502-HY			
52		2502-HY			
53		2502-HY			
54	A	2502-HY	no	6	yes
55		2502-HY			
56		2502-HY			
57		2502-HY			
58		2502-HY			

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

Hay (2502-HY)

Methods PBDEs - Accreditation, weighed sample, standards

LC	Data set	Sample	Accreditation according to ISO/IEC 17025	Weighed sample [g]	Use of isotope-labelled internal standards for PBDE congeners (yes/no)
59		2502-HY			
60	A	2502-HY	yes	36	yes
61		2502-HY			
62		2502-HY			
63		2502-HY			
64		2502-HY			
65		2502-HY			
66		2502-HY			
67		2502-HY			
68	A	2502-HY		10	yes
69		2502-HY			
70		2502-HY			
71		2502-HY			
72	A	2502-HY	no	10.0589	yes
73		2502-HY			
74		2502-HY			
75		2502-HY			
76		2502-HY			
77		2502-HY			
78	A	2502-HY	yes	10	yes
79	A	2502-HY	no	2.668	yes
80	A	2502-HY	yes	5	yes
81		2502-HY			
82	A	2502-HY	no	31.97	yes
83		2502-HY			
84		2502-HY			
85		2502-HY			
86	A	2502-HY	yes	5	yes
87		2502-HY			
88		2502-HY			
89	A	2502-HY	yes	29.737	yes
90		2502-HY			
91		2502-HY			
92		2502-HY			
93		2502-HY			
94		2502-HY			
95	A	2502-HY	yes	5	yes
96		2502-HY			
97		2502-HY			
Additional Sets					
16	B	2502-HY	no	10	yes
86	B	2502-HY	no	5	yes

LC	Data set	Sample	BDE 28 Internal standard	BDE 47 Internal standard	BDE 49 Internal standard	BDE 99 Internal standard	BDE 100 Internal standard	BDE 153 Internal standard	BDE 154 Internal standard	BDE 183 Internal standard	BDE 209 Internal standard	BDE 28 Recovery standard	BDE 47 Recovery standard	BDE 49 Recovery standard	BDE 99 Recovery standard	BDE 100 Recovery standard	BDE 153 Recovery standard	BDE 154 Recovery standard	BDE 183 Recovery standard	BDE 209 Recovery standard	
1		2502-HY																			
2		2502-HY																			
3		2502-HY																			
4		2502-HY																			
5		2502-HY																			
6	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
7	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
8		2502-HY																			
9	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
10		2502-HY																			
11	A	2502-HY																			
12		2502-HY																			
13		2502-HY																			
14		2502-HY																			
15		2502-HY																			
16	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
17		2502-HY																			
18	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
19		2502-HY																			
20		2502-HY																			
21		2502-HY																			
22		2502-HY																			
23		2502-HY																			
24		2502-HY																			
25		2502-HY																			
26	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
27	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-PCB-52	13C12-PCB-52	13C12-PCB-52	13C12-PCB-138	13C12-PCB-138	13C12-PCB-138	13C12-PCB-138	13C12-PCB-138	13C12-PCB-138	
28		2502-HY																			
29		2502-HY																			
30		2502-HY																			
31		2502-HY																			
32		2502-HY																			
33		2502-HY																			
34	A	2502-HY	BDE-28	BDE-47	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-209	PCB-138	PCB-138	PCB-138	PCB-138	PCB-138	PCB-138	PCB-138	PCB-138	PCB-138	
35		2502-HY																			
36		2502-HY																			
37		2502-HY																			
38		2502-HY																			
39	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
40		2502-HY																			
41		2502-HY																			
42		2502-HY																			
43		2502-HY																			
44	A	2502-HY	MBDE-28	MBDE-47	MBDE-47	MBDE-99	MBDE-100	MBDE-153	MBDE-154	MBDE-183	MBDE-209	MBDE-79	MBDE-79	MBDE-79	MBDE-139	MBDE-139	MBDE-139	MBDE-139	MBDE-139	MBDE-206	
45	A	2502-HY	13C12 BDE-28	13C12 BDE-47	13C12 BDE-47	13C12 BDE-99	13C12 BDE-100	13C12 BDE-153	13C12 BDE-154	13C12 BDE-183	13C12 BDE-209	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	13C12 BDE-138	
46		2502-HY																			
47		2502-HY																			
48		2502-HY																			
49		2502-HY																			
50		2502-HY																			
51		2502-HY																			
52		2502-HY																			
53		2502-HY																			
54	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	13C12-BDE-138	
55		2502-HY																			
56		2502-HY																			
57		2502-HY																			
58		2502-HY																			
59	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-77	13C12-BDE-77	13C12-BDE-77	13C12-BDE-126	13C12-BDE-126	13C12-BDE-126	13C12-BDE-126	13C12-BDE-126	13C12-BDE-126	
60		2502-HY																			
61		2502-HY																			
62		2502-HY																			
63		2502-HY																			
64		2502-HY																			
65		2502-HY																			
66		2502-HY																			
67		2502-HY																			
68	A	2502-HY	13C bde 28	13C bde 47	13C bde 47	13C bde 99	13C bde 100	13c bde 153	13c bde 154	13c bde 183	13c bde 209	13c bde 139	13c bde 139	13c bde 139	13c bde 139	13c bde 139	13c bde 139	13c bde 139	13c bde 139	13c bde 139	
69		2502-HY																			
70		2502-HY																			
71		2502-HY																			
72	A	2502-HY	BDE-28	BDE-47	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-209	PCB-52	PCB-52	PCB-52	PCB-52	PCB-52	PCB-138	PCB-138	PCB-138	PCB-138	
73		2502-HY																			
74		2502-HY																			
75		2502-HY																			
76		2502-HY																			
77		2502-HY																			
78	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	
79	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	
80	A	2502-HY	13C12-BDE-28	13C12-BDE-47	13C12-BDE-47	13C12-BDE-99	13C12-BDE-100	13C12-BDE-153	13C12-BDE-154	13C12-BDE-183	13C12-BDE-209	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	13C12-BDE-139	
81		2502-HY																			
82	A	2502-HY	BDE-28	BDE-47	BDE-47	BDE-99	BDE-100	BDE-153	BDE-154	BDE-183	BDE-209										

Hay (2502-HY)
 Methods PBDEs - Extraction

LC	Data set	Sample	Extraction	Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [°C]	Extraction pressure [MPa]
1		2502-HY							
2		2502-HY							
3		2502-HY							
4		2502-HY							
5		2502-HY							
6		2502-HY							
7	A	2502-HY		-	Pressurized liquid extraction	(1) Toluene - (2) Toluene:Ethanol 90:10	0.25	100	10.3
8		2502-HY							
9	A	2502-HY		homogenization	Pressurized liquid extraction				
10		2502-HY							
11	A	2502-HY			Soxhlet	toluene/acetone 7/3	6		
12		2502-HY							
13		2502-HY							
14		2502-HY							
15		2502-HY							
16	A	2502-HY			Pressurized liquid extraction	Hexane/Acetone (70:30)	1	125	10.3
17		2502-HY							
18	A	2502-HY			Soxhlet	toluene/ethanol 70/30	12	bp	ambient
19		2502-HY							
20		2502-HY							
21		2502-HY							
22		2502-HY							
23		2502-HY							
24		2502-HY							
25		2502-HY							
26	A	2502-HY		drying	Pressurized liquid extraction	Toluene / Acetone (70 / 30)	1	120	10
27	A	2502-HY		thorough homogenization	Soxhlet	toluene:methanol 2:1	21	109	0,1
28		2502-HY							
29		2502-HY							
30		2502-HY							
31		2502-HY							
32		2502-HY							
33		2502-HY							
34	A	2502-HY		homogenization; drying to determine moisture content	Pressurized liquid extraction , Soxhlet	ASE: toluene, toluene:EtOH (9:1, v/v); Soxhlet: toluene	ASE: 40 min; Soxhlet: 8 h	ASE: 100 °C	ASE: 10,34 MPa; Soxhlet: atm. pressure
35		2502-HY							
36		2502-HY							
37		2502-HY							
38		2502-HY							
39	A	2502-HY		Homogenisation	Soxhlet	toluene/ethanol 50/50	24	120	0.1013
40		2502-HY							
41		2502-HY							
42		2502-HY							
43		2502-HY							
44	A	2502-HY		-	Pressurized liquid extraction	1) Toluol (cycles: 1) 2) Toluol/Ethanol (9:1) (cycles: 2)	1 h	100 °C	10 MPa
45	A	2502-HY		homogenisation	Soxhlet	toluene/acetone	16		
46		2502-HY							
47		2502-HY							
48		2502-HY							
49		2502-HY							
50		2502-HY							
51		2502-HY							
52		2502-HY							
53		2502-HY							
54	A	2502-HY			Soxhlet	Hexane/Dichloromethane (1/1)	24		
55		2502-HY							
56		2502-HY							
57		2502-HY							
58		2502-HY							
59		2502-HY							
60	A	2502-HY			Soxhlet	Toluene / Ethanol (30/70)	12	boiling point of solvant mixture	
61		2502-HY							
62		2502-HY							
63		2502-HY							
64		2502-HY							
65		2502-HY							
66		2502-HY							
67		2502-HY							
68	A	2502-HY			Soxhlet	DCM:hex 1:1	6	80	room
69		2502-HY							
70		2502-HY							
71		2502-HY							
72	A	2502-HY		hydromatrix added	ASE	Hexane/Acetona (5:1)	20 min	100 °C	1500 psi
73		2502-HY							

Hay (2502-HY)
 Methods PBDEs - Extraction

LC	Data set	Sample	Extraction	Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [°C]	Extraction pressure [MPa]
74		2502-HY							
75		2502-HY							
76		2502-HY							
77		2502-HY							
78	A	2502-HY		no	Pressurized liquid extraction	toluene /acetone (70/30, v/v)	0,5	100	10
79	A	2502-HY			Pressurized liquid extraction	hexane/acetone 1:1	0,5	100	10.3
80	A	2502-HY			Soxhlet	Toluene	12		
81		2502-HY							
82	A	2502-HY		drying the sample in a vacuum oven, then, mixed with sodium sulphate before extraction	Twisselmann	n-hexane:DCM (1:1)	24		
83		2502-HY							
84		2502-HY							
85		2502-HY							
86	A	2502-HY			QuEChERS like-extraction	Ethyl acetate			
87		2502-HY							
88		2502-HY							
89	A	2502-HY		-	Pressurized liquid extraction	Toluene	1	150	13
90		2502-HY							
91		2502-HY							
92		2502-HY							
93		2502-HY							
94		2502-HY							
95	A	2502-HY		homogenization	Pressurized liquid extraction				
96		2502-HY							
97		2502-HY							
Additional Sets									
16	B	2502-HY			Pressurized liquid extraction	Hexane/Acetone (70:30)	1	125	10.3
86	B	2502-HY			QuEChERS like-extraction	Ethyl acetate			

Hay (2502-HY)

Methods PBDEs - Clean-up

LC	Data set	Sample	Clean-up						Other columns / clean-up method	Final volume [µl]: PBDE
			Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Fully automated system		
1		2502-HY								
2		2502-HY								
3		2502-HY								
4		2502-HY								
5		2502-HY								
6		2502-HY								
7	A	2502-HY	no	no	no	no	no	DexTech	no	100
8		2502-HY								
9	A	2502-HY	no	yes	no	no	no	no	no	100
10		2502-HY								
11	A	2502-HY	no	yes	no	yes	yes	DexTech	no	100
12		2502-HY								
13		2502-HY								
14		2502-HY								
15		2502-HY								
16	A	2502-HY	no	yes	no	yes	yes	no	acid hydrolysis with sulphuric acid	60
17		2502-HY								
18	A	2502-HY	no	yes	no	yes	yes	no		500
19		2502-HY								
20		2502-HY								
21		2502-HY								
22		2502-HY								
23		2502-HY								
24		2502-HY								
25		2502-HY								
26	A	2502-HY	no	no	no	no	no	Miura	no	20
27	A	2502-HY	no	yes	no	yes	yes	no	basic silica, silver nitrate silica	50
28		2502-HY								
29		2502-HY								
30		2502-HY								
31		2502-HY								
32		2502-HY								
33		2502-HY								
34	A	2502-HY	no	yes	yes	yes	yes	yes	Power-Prep FMS with PBDE Free disp. columns; Supelco Supelclean TM Sulfoxide SPE 6 g/ 20 ml (removal of waxes)	20
35		2502-HY								
36		2502-HY								
37		2502-HY								
38		2502-HY								
39	A	2502-HY	no	yes	no	yes	no	no		25
40		2502-HY								
41		2502-HY								
42		2502-HY								
43		2502-HY								
44	A	2502-HY	no	no	no	no	no	Miura	no	50
45	A	2502-HY	no	no	no	yes	no	no		20
46		2502-HY								
47		2502-HY								
48		2502-HY								
49		2502-HY								
50		2502-HY								
51		2502-HY								
52		2502-HY								
53		2502-HY								
54	A	2502-HY	no	yes	no	yes	no	no		20
55		2502-HY								
56		2502-HY								
57		2502-HY								
58		2502-HY								
59		2502-HY								
60	A	2502-HY	no	yes	no	yes	no	no	acidic treatment	50
61		2502-HY								
62		2502-HY								
63		2502-HY								
64		2502-HY								
65		2502-HY								
66		2502-HY								
67		2502-HY								
68	A	2502-HY	yes	yes	no	no	yes	yes		20
69		2502-HY								
70		2502-HY								
71		2502-HY								
72	A	2502-HY	no	no	no	no	no	Miura	no	20
73		2502-HY								

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Methods PBDEs - Clean-up

LC	Data set	Sample	Clean-up							Other columns / clean-up method	Final volume [µl]: PBDE
			Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Fully automated system	Semi-automated system		
74		2502-HY									
75		2502-HY									
76		2502-HY									
77		2502-HY									
78	A	2502-HY	no	yes	yes	yes	no		no		50
79	A	2502-HY	no	yes	no	no	no		no		2500
80	A	2502-HY	no	yes	no	yes	yes	Miura	no	Silica/AgNO3	100
81		2502-HY									
82	A	2502-HY	no	yes	no	no	no		no	basic set of "power-prep system" columns	40
83		2502-HY									
84		2502-HY									
85		2502-HY									
86	A	2502-HY	no	yes	no	no	no		no	d-SPE on Agilent EMR dispersive kit	250
87		2502-HY									
88		2502-HY									
89	A	2502-HY	no	yes	no	yes	yes	DexTech	no		100
90		2502-HY									
91		2502-HY									
92		2502-HY									
93		2502-HY									
94		2502-HY									
95	A	2502-HY	no	yes	no	no	no		no		100
96		2502-HY									
97		2502-HY									
Additional Sets											
16	B	2502-HY	no	yes	no	yes	yes		no	acid hydrolysis with sulphuric acid	60
86	B	2502-HY	no	yes	no	no	no		no	d-SPE on Agilent EMR dispersive kit	250

LC	Data set	Sample	Chromatographic separation and detection method			Detector	Limit of quantification Determination of LOQ	Measurement uncertainty Estimation
			GC injection	Injected volume [µl]	GC separation: Stationary phase			
1		2502-HY						
2		2502-HY						
3		2502-HY						
4		2502-HY						
5		2502-HY						
6		2502-HY						
7	A	2502-HY	PTV	4	RTX-1614	HRMS	LOQs were based on the blank level contamination and on the signal to noise (for compounds not present in the blank)	MU was calculated according to the dioxin guideline based on replicates of PTs samples. A single MU have been calculated for all the matrices using the same extraction, purification and GC-MS method
8		2502-HY						
9	A	2502-HY	Splitless	2		MS/MS	2 times higher than blanks and S/N ratio over 10	Proficiency testing and spiked samples
10		2502-HY						
11	A	2502-HY	Splitless	2	DB5 MS	HRMS		
12		2502-HY						
13		2502-HY						
14		2502-HY						
15		2502-HY						
16	A	2502-HY	PTV	2	Rtx-1614 30m x 0.25mm x 0.1µm□	HRMS	The LOQs were estimated using the approach "Congener-based LOQs from S/N Calculations". This methodology is reported in the Guidance Document on the Estimation of LOD and LOQ for Measurements in the Field of Contaminants in Feed and Food.	The MU was estimated using the "semi-empirical approach" based on the ISO Guide to the expression of Uncertainty in Measurement applied to analytical chemistry by EURACHEM/CITAC. This approach is reported in the Guidance Document on Measurement Uncertainty for Laboratories performing PCDD/F and PCB Analysis using Isotope Dilution Mass Spectrometry
17		2502-HY						
18	A	2502-HY	Splitless	5	(5%-phenyl)-methylpolysiloxane	MS/MS		
19		2502-HY						
20		2502-HY						
21		2502-HY						
22		2502-HY						
23		2502-HY						
24		2502-HY						
25		2502-HY						
26	A	2502-HY	Splitless	2	DB5MS	HRMS	LOD = LOQ (S/N =3)	GUM
27	A	2502-HY	pulsed splitless	1	DB-5MS (60m x 0,25mm x 0,10 µm)	HRMS	estimated from procedural blanks	based on validation - calculation from RSD and bias
28		2502-HY						
29		2502-HY						
30		2502-HY						
31		2502-HY						
32		2502-HY						
33		2502-HY						
34	A	2502-HY	Splitless	2	DB-5HT	HRMS	LOQ = 3 x LOD, LOD evaluated as 3 times of noise	Expanded U: $U_e = k \times U_c$ ($k = 2$). MU of type A is evaluated using internal RM. U of type B (includes i.a. uncertainty of weighing, volume measurements, etc.), U_c = combined uncertainty is summed uncertainty of type A and B according the law of propagation of measurement uncertainty.
35		2502-HY						
36		2502-HY						
37		2502-HY						
38		2502-HY						
39	A	2502-HY	Splitless	1	Rtx-1614	HRMS		
40		2502-HY						
41		2502-HY						
42		2502-HY						
43	A	2502-HY	PTV	4	Rtx-1614 (15m x 0,25 mm x 0,1 µm) + 2m retention gap (uncoated)	MS/MS		
44	A	2502-HY	PTV	2	30 m DB-5 MS 0,25 mm 0,25 µm	HRMS	LOQ = 3 * Limit of Detection (LOD), LOD determined using blank samples	nach DIN ISO 11352:2013-03 Chapter. 8.2, Abs. 8.2.2
45		2502-HY						
46		2502-HY						
47		2502-HY						
48		2502-HY						
49		2502-HY						
50		2502-HY						
51		2502-HY						
52		2502-HY						

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Methods PBDEs - Detection, LOQ, measurement uncertainty

LC	Data set	Sample	Chromatographic separation and detection method			Detector	Limit of quantification Determination of LOQ	Measurement uncertainty Estimation
			GC injection	Injected volume [µl]	GC separation: Stationary phase			
53		2502-HY						
54	A	2502-HY	Splitless	1	DB5MS	HRMS		
55		2502-HY						
56		2502-HY						
57		2502-HY						
58		2502-HY						
59		2502-HY						
60	A	2502-HY	Splitless	2	DB-5HT	HRMS	The LOQ was determined with fortified matrix.	
61		2502-HY					The measurement uncertainty was calculated according to NF ISO 11352.	
62		2502-HY						
63		2502-HY						
64		2502-HY						
65		2502-HY						
66		2502-HY						
67		2502-HY						
68	A	2502-HY	PTV	5	phenomenex zebron ZB semi volatiles	MS/MS	0.01 (lowest spiked level reaching requirements, mentioned in the EURL recommendation)	
69		2502-HY					taking into account uncertainty from bias and RSD under reproducibility conditions and rounding up	
70		2502-HY						
71		2502-HY						
72	A	2502-HY	Splitless	1	DB5ms	HRMS	quantitation software calculation based on s/n	
73		2502-HY					Horwitz	
74		2502-HY						
75		2502-HY						
76		2502-HY						
77		2502-HY						
78	A	2502-HY	PTV	1.5	RTX-1614 , DB-5-MS	HRMS	calculated from validation and verified with a blank sample	
79	A	2502-HY	PTV	100	Rtx-CL Pesticides	HRMS	LOR = 0.004 µg/kg 12% moisture, determined by validation study	
80	A	2502-HY	PTV	1	ZB-Semivolatiles	MS/MS	Mean of Blank + 3s	
81		2502-HY					multiple analysis of reference material	
82	A	2502-HY	Splitless	1	DB-5MS (30 m, 0.25 mm id, 0.25 mm film)	HRMS	LOQs were calculated using the "Quandesk" software	
83		2502-HY						
84		2502-HY						
85		2502-HY						
86	A	2502-HY	PTV	10	DB5HT 15 m x 0.25 mm; 0.1 µm	MS/MS	0.020 µg/kg (0.100 µg/kg for BDE 209) determined by fortified samples	
87		2502-HY						
88		2502-HY						
89	A	2502-HY	Splitless	1	5MS	MS/MS	Not calculated (No validation available)	
90		2502-HY					Estimated (No validation available)	
91		2502-HY						
92		2502-HY						
93		2502-HY						
94		2502-HY						
95	A	2502-HY	Splitless	2		MS/MS	2 times higher than blanks and S/N ratio over 10	
96		2502-HY					Proficiency testing and spiked samples	
97		2502-HY						
Additional Sets								
16	B	2502-HY		5		HRMS		
86	B	2502-HY	PTV	10	DB5HT 15 m x 0.25 mm; 0.1 µm	MS/MS	0.020 µg/kg (0.100 µg/kg for BDE 209) determined by fortified samples	



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 7: Assigned values of HBCDDs

Test sample - Hay (2502-HY)

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



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

HBCDD - Assigned values

Analyte	Result µg/kg (12% moisture content)	Assigned value [outliers removed]	Robust standard deviation [outliers removed]	Standard uncertainty [outliers removed]	No. of results contributing to assigned value	Median [all values]
Sum of α-, β-, γ-HBCDD (ub)		1.08	0.232	0.075	15	1.04
Sum of α-, β-, γ-HBCDD (lb)		1.07	0.246	0.079	15	1.04
(+/-)-α-HBCDD (1,2,5,6,9,10-hexabromo-(1R,2R,5S,6R,9R,10S)-rel-cyclododecane)		0.107	0.0145	0.0047	15	0.110
(+/-)-β- HBCDD (1,2,5,6,9,10-hexabromo-(1R,2S,5R,6R,9R,10S)-rel-cyclododecane)						0.0250
(+/-)-γ- HBCDD (1,2,5,6,9,10-hexabromo-(1R,2R,5R,6S,9S,10R)-rel-cyclododecane)		0.969	0.225	0.070	16	0.918
Total HBCDD (using GC-methods)						



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Moisture content (HBCDD) - Assigned value

Analyte	Result %	Assigned value [outliers removed]	Robust standard deviation [outliers removed]	Standard uncertainty [outliers removed]	No. of results contributing to assigned value	Median [all values]
Moisture content		8.34	0.629	0.17	21	



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 8: Participants' results of HBCDDs

Test sample - Hay (2502-HY)

Hay (2502-HY)
HBCDD - Results

LC	Data set	Sample	Result µg/kg 12% moisture content	Sum of α-, β-, γ-HBCDD (ub)	Sum of α-, β-, γ-HBCDD (lb)	(+/-)-α-HBCDD		(+/-)-β- HBCDD		(+/-)-γ- HBCDD		Total HBCDD (using GC-methods)
						1,2,5,6,9,10-hexabromo-(1R,2R,5S,6R,9R,10S)- rel-cyclododecane	1,2,5,6,9,10-hexabromo-(1R,2S,5R,6R,9R,10S)- rel-cyclododecane	1,2,5,6,9,10-hexabromo-(1R,2R,5R,6R,9R,10S)- rel-cyclododecane	1,2,5,6,9,10-hexabromo-(1R,2R,5R,6S,9S,10R)- rel-cyclododecane			
1	A	2502-HY		0.92	0.91	0.08		0.01		0.82		
2		2502-HY										
3		2502-HY										
4		2502-HY										
5		2502-HY										
6		2502-HY										
7		2502-HY										
8		2502-HY										
9	A	2502-HY		1.01	0.992	0.095		<0.02		0.897		
10		2502-HY										
11	A	2502-HY		1.23	1.22	0.112		<0.01		1.1		
12		2502-HY										
13		2502-HY										
14		2502-HY										
15	A	2502-HY		0.824	0.79	0.078		<0.03		0.712		
16	A	2502-HY		1.33	1.33	0.112		0.0165		1.2		
17		2502-HY										
18	A	2502-HY		1.36	1.36	0.13		0.027		1.2		
19		2502-HY										
20	A	2502-HY		1.4	1.4	0.12				1.26		
21		2502-HY										
22		2502-HY										
23		2502-HY										
24		2502-HY										
25		2502-HY										
26	A	2502-HY		1.02	1.02	0.113		0.015		0.894		
27	A	2502-HY		0.919	0.869	0.104		<0.05		0.765		
28		2502-HY										
29		2502-HY										
30		2502-HY										
31		2502-HY										
32		2502-HY										
33		2502-HY										
34		2502-HY										
35		2502-HY										
36	A	2502-HY		3.29	3.01	<0.191		<0.096		3.01		
37		2502-HY										
38		2502-HY										
39	A	2502-HY		1.15	1.13	0.14		<0.025		0.989		
40		2502-HY										
41		2502-HY										
42		2502-HY										
43		2502-HY										
44	A	2502-HY		1.04	1.04	0.104		0.0153		0.918		
45		2502-HY										
46		2502-HY										
47		2502-HY										
48		2502-HY										
49		2502-HY										
50		2502-HY										
51		2502-HY										
52		2502-HY										
53		2502-HY										
54		2502-HY										
55		2502-HY										
56		2502-HY										
57		2502-HY										
58		2502-HY										
59		2502-HY										
60		2502-HY										
61		2502-HY										
62		2502-HY										
63		2502-HY										
64		2502-HY										
65		2502-HY										
66		2502-HY										
67		2502-HY										

Hay (2502-HY)
 HBCDD - Results

LC	Data set	Sample	Result µg/kg 12% moisture content	Sum of α-, β-, γ-HBCDD (ub)	Sum of α-, β-, γ-HBCDD (lb)	HBCDD isomers			Total HBCDD (using GC-methods)
						(+/-)-α-HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5S,6R,9R,10S)- rel-cyclododecane	(+/-)-β- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2S,5R,6R,9R,10S)- rel-cyclododecane	(+/-)-γ- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5R,6S,9S,10R)- rel-cyclododecane	
68	A	2502-HY		1.31	1.31	0.101	0.01	1.2	
69		2502-HY							
70		2502-HY							
71		2502-HY							
72		2502-HY							
73		2502-HY							
74		2502-HY							
75		2502-HY							
76		2502-HY							
77		2502-HY							
78	A	2502-HY		0.98	0.95	0.11	<0.03	0.85	
79		2502-HY							
80		2502-HY							
81		2502-HY							
82		2502-HY							
83		2502-HY							
84		2502-HY							
85		2502-HY							
86	A	2502-HY		0.61	0.56	0.1	<0.05	0.46	
87		2502-HY							
88		2502-HY							
89	A	2502-HY		2.1	2.1	0.53	0.37	1.19	
90		2502-HY							
91		2502-HY							
92		2502-HY							
93		2502-HY							
94		2502-HY							
95	A	2502-HY		1.01	0.989	0.107	<0.02	0.882	
96		2502-HY							
97		2502-HY							
Additional Sets									
86	B	2502-HY		2.63	2.58	0.1	<0.05	2.48	

Hay (2502-HY)
 Moisture content (HBCDD) - Results

LC	Data set	Sample	Result %	Moisture content HBCDD
1	A	2502-HY		7.9
2		2502-HY		
3		2502-HY		
4		2502-HY		
5		2502-HY		
6		2502-HY		
7		2502-HY		
8		2502-HY		
9	A	2502-HY		91.6
10		2502-HY		
11	A	2502-HY		91.3
12		2502-HY		
13		2502-HY		
14		2502-HY		
15	A	2502-HY		
16	A	2502-HY		8.28
17		2502-HY		
18	A	2502-HY		8
19		2502-HY		
20	A	2502-HY		8.47
		2502-HY		
22		2502-HY		
23		2502-HY		
24		2502-HY		
25		2502-HY		
26	A	2502-HY		7.9
27	A	2502-HY		8.21
28		2502-HY		
29		2502-HY		
30		2502-HY		
31		2502-HY		
32		2502-HY		
33		2502-HY		
34		2502-HY		
35		2502-HY		
36	A	2502-HY		7.7
37		2502-HY		
38		2502-HY		
39	A	2502-HY		8.41
40		2502-HY		
41		2502-HY		
42		2502-HY		
43		2502-HY		
44	A	2502-HY		8.3
45		2502-HY		
46		2502-HY		
47		2502-HY		
48		2502-HY		
49		2502-HY		
50		2502-HY		
51		2502-HY		
52		2502-HY		
53		2502-HY		
54		2502-HY		

Hay (2502-HY)
 Moisture content (HBCDD) - Results

LC	Data set	Sample	Result %	Moisture content HBCDD
55		2502-HY		
56		2502-HY		
57		2502-HY		
58		2502-HY		
59		2502-HY		
60		2502-HY		
61		2502-HY		
62		2502-HY		
63		2502-HY		
64		2502-HY		
65		2502-HY		
66		2502-HY		
67		2502-HY		
68	A	2502-HY		8.25
69		2502-HY		
70		2502-HY		
71		2502-HY		
72		2502-HY		
73		2502-HY		
74		2502-HY		
75		2502-HY		
76		2502-HY		
77		2502-HY		
78	A	2502-HY		8.63
79		2502-HY		
80		2502-HY		
81		2502-HY		
82		2502-HY		
83		2502-HY		
84		2502-HY		
85		2502-HY		
86	A	2502-HY		8
87		2502-HY		
88		2502-HY		
89	A	2502-HY		7.52
90		2502-HY		
91		2502-HY		
92		2502-HY		
93		2502-HY		
94		2502-HY		
95	A	2502-HY		90.2
96		2502-HY		
97		2502-HY		
Additional Sets				
86	B	2502-HY		8



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 9: Participants' z-scores of HBCDDs - Tables

Test sample - Hay (2502-HY)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value

$$z = (x - x_a) / (\sigma_{\text{prel}} * x_a)$$

x_a : assigned value

x : participant's result

σ_{prel} : fitness-for-purpose-based standard deviation for proficiency assessment

20%: Evaluated individual HBCDD diastereomers and sum parameters

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 HBCDD - Z-scores

LC	Data set	Sample	Z-score [σ _p = 20 %]	Sum of α-, β-, γ-HBCDD (ub)	Sum of α-, β-, γ-HBCDD (lb)	(+/-)-α-HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5S,6R,9R,10S)- rel-cyclododecane	(+/-)-β- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2S,5R,6R,9R,10S)- rel-cyclododecane	(+/-)-γ- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5R,6S,9S,10R)- rel-cyclododecane	Total HBCDD* (using GC-methods)
1	A	2502-HY		-0.7	-0.7	-1.3		-0.8	
2		2502-HY							
3		2502-HY							
4		2502-HY							
5		2502-HY							
6		2502-HY							
7		2502-HY							
8		2502-HY							
9	A	2502-HY		-0.3	-0.4	-0.6		-0.4	
10		2502-HY							
11	A	2502-HY		0.7	0.7	0.2		0.7	
12		2502-HY							
13		2502-HY							
14		2502-HY							
15	A	2502-HY		-1.2	-1.3	-1.4		-1.3	
16	A	2502-HY		1.2	1.2	0.2		1.2	
17		2502-HY							
18	A	2502-HY		1.3	1.4	1.1		1.2	
19		2502-HY							
20	A	2502-HY		1.5	1.5	0.6		1.5	
21		2502-HY							
22		2502-HY							
23		2502-HY							
24		2502-HY							
25		2502-HY							
26	A	2502-HY		-0.3	-0.2	0.3		-0.4	
27	A	2502-HY		-0.7	-0.9	-0.1		-1.1	
28		2502-HY							
29		2502-HY							
30		2502-HY							
31		2502-HY							
32		2502-HY							
33		2502-HY							
34		2502-HY							
35		2502-HY							
36	A	2502-HY		10.2	9.1			10.5	
37		2502-HY							
38		2502-HY							
39	A	2502-HY		0.3	0.3	1.5		0.1	
40		2502-HY							
41		2502-HY							
42		2502-HY							
43		2502-HY							
44	A	2502-HY		-0.2	-0.1	-0.1		-0.3	
45		2502-HY							
46		2502-HY							
47		2502-HY							
48		2502-HY							
49		2502-HY							
50		2502-HY							
51		2502-HY							
52		2502-HY							
53		2502-HY							
54		2502-HY							
55		2502-HY							
56		2502-HY							
57		2502-HY							

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

HBCDD - Z-scores

LC	Data set	Sample	Z-score [σ _p = 20 %]	Sum of α-, β-, γ-HBCDD (ub)	Sum of α-, β-, γ-HBCDD (lb)	(+/-)-α-HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5S,6R,9R,10S)- rel-cyclododecane	(+/-)-β- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2S,5R,6R,9R,10S)- rel-cyclododecane	(+/-)-γ- HBCDD 1,2,5,6,9,10-hexabromo-(1R,2R,5R,6S,9S,10R)- rel-cyclododecane	Total HBCDD* (using GC-methods)
58		2502-HY							
59		2502-HY							
60		2502-HY							
61		2502-HY							
62		2502-HY							
63		2502-HY							
64		2502-HY							
65		2502-HY							
66		2502-HY							
67		2502-HY							
68	A	2502-HY		1.1	1.1	-0.3		1.2	
69		2502-HY							
70		2502-HY							
71		2502-HY							
72		2502-HY							
73		2502-HY							
74		2502-HY							
75		2502-HY							
76		2502-HY							
77		2502-HY							
78	A	2502-HY		-0.5	-0.6	0.1		-0.6	
79		2502-HY							
80		2502-HY							
81		2502-HY							
82		2502-HY							
83		2502-HY							
84		2502-HY							
85		2502-HY							
86	A	2502-HY		-2.2	-2.4	-0.3		-2.6	
87		2502-HY							
88		2502-HY							
89	A	2502-HY		4.7	4.8	19.8		1.1	
90		2502-HY							
91		2502-HY							
92		2502-HY							
93		2502-HY							
94		2502-HY							
95	A	2502-HY		-0.3	-0.4	0.0		-0.4	
96		2502-HY							
97		2502-HY							
Additional Sets									
86	B	2502-HY		7.2	7.1	-0.3		7.8	

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-H
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Moisture content (HBCDD) - Z-scores

LC	Data set	Sample	Z-score [$\sigma_p = 10\%$]	Moisture content PBDE
1	A	2502-HY		-0.5
2		2502-HY		
3		2502-HY		
4		2502-HY		
5		2502-HY		
6		2502-HY		
7		2502-HY		
8		2502-HY		
9	A	2502-HY		99.8
10		2502-HY		
11	A	2502-HY		99.5
12		2502-HY		
13		2502-HY		
14		2502-HY		
15	A	2502-HY		
16	A	2502-HY		-0.1
17		2502-HY		
18	A	2502-HY		-0.4
19		2502-HY		
20	A	2502-HY		0.2
21		2502-HY		
22		2502-HY		
23		2502-HY		
24		2502-HY		
25		2502-HY		
26	A	2502-HY		-0.5
27	A	2502-HY		-0.2
28		2502-HY		
29		2502-HY		
30		2502-HY		
31		2502-HY		
32		2502-HY		
33		2502-HY		
34		2502-HY		
35		2502-HY		
36	A	2502-HY		-0.8
37		2502-HY		
38		2502-HY		
39	A	2502-HY		0.1
40		2502-HY		
41		2502-HY		
42		2502-HY		
43		2502-HY		
44	A	2502-HY		0.0
45		2502-HY		
46		2502-HY		
47		2502-HY		
48		2502-HY		
49		2502-HY		
50		2502-HY		
51		2502-HY		
52		2502-HY		
53		2502-HY		
54		2502-HY		
55		2502-HY		
56		2502-HY		
57		2502-HY		

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-H
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Moisture content (HBCDD) - Z-scores

LC	Data set	Sample	Z-score [$\sigma_p = 10\%$]	Moisture content PBDE
58		2502-HY		
59		2502-HY		
60		2502-HY		
61		2502-HY		
62		2502-HY		
63		2502-HY		
64		2502-HY		
65		2502-HY		
66		2502-HY		
67		2502-HY		
68	A	2502-HY		-0.1
69		2502-HY		
70		2502-HY		
71		2502-HY		
72		2502-HY		
73		2502-HY		
74		2502-HY		
75		2502-HY		
76		2502-HY		
77		2502-HY		
78	A	2502-HY		0.3
79		2502-HY		
80		2502-HY		
81		2502-HY		
82		2502-HY		
83		2502-HY		
84		2502-HY		
85		2502-HY		
86	A	2502-HY		-0.4
87		2502-HY		
88		2502-HY		
89	A	2502-HY		-1.0
90		2502-HY		
91		2502-HY		
92		2502-HY		
93		2502-HY		
94		2502-HY		
95	A	2502-HY		98.2
96		2502-HY		
97		2502-HY		
Additional Sets				
86	B	2502-HY		-0.4



EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 10: Participants' z-scores of HBCDDs - Charts

Test sample - Hay (2502-HY)

Z-scores of sum parameters and individual results

Calculation of z-score on basis of assigned value


$$z = (x - x_a) / (\sigma_{\text{prel}} * x_a)$$


x_a : assigned value

x : participant's result

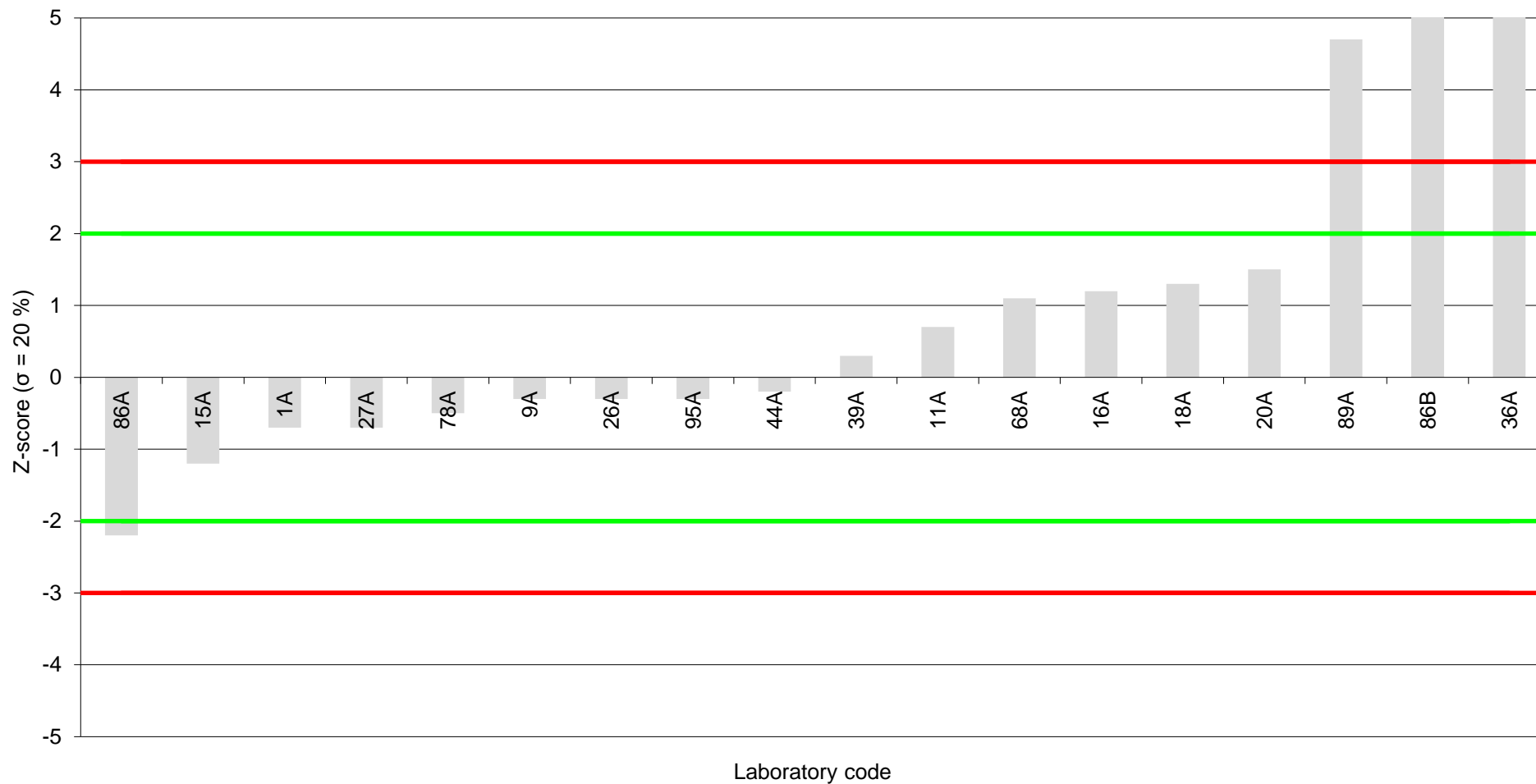
σ_{prel} : fitness-for-purpose-based standard deviation for proficiency assessment

20%: Evaluated individual HBCDD diastereomers and sum parameters

± 2 z-scores: 

± 3 z-scores: 

Hay (2502-HY)
Sum of α -, β -, γ -HBCDD ub
Assigned value: 1.08 $\mu\text{g}/\text{kg}$ product (12 % moisture content)



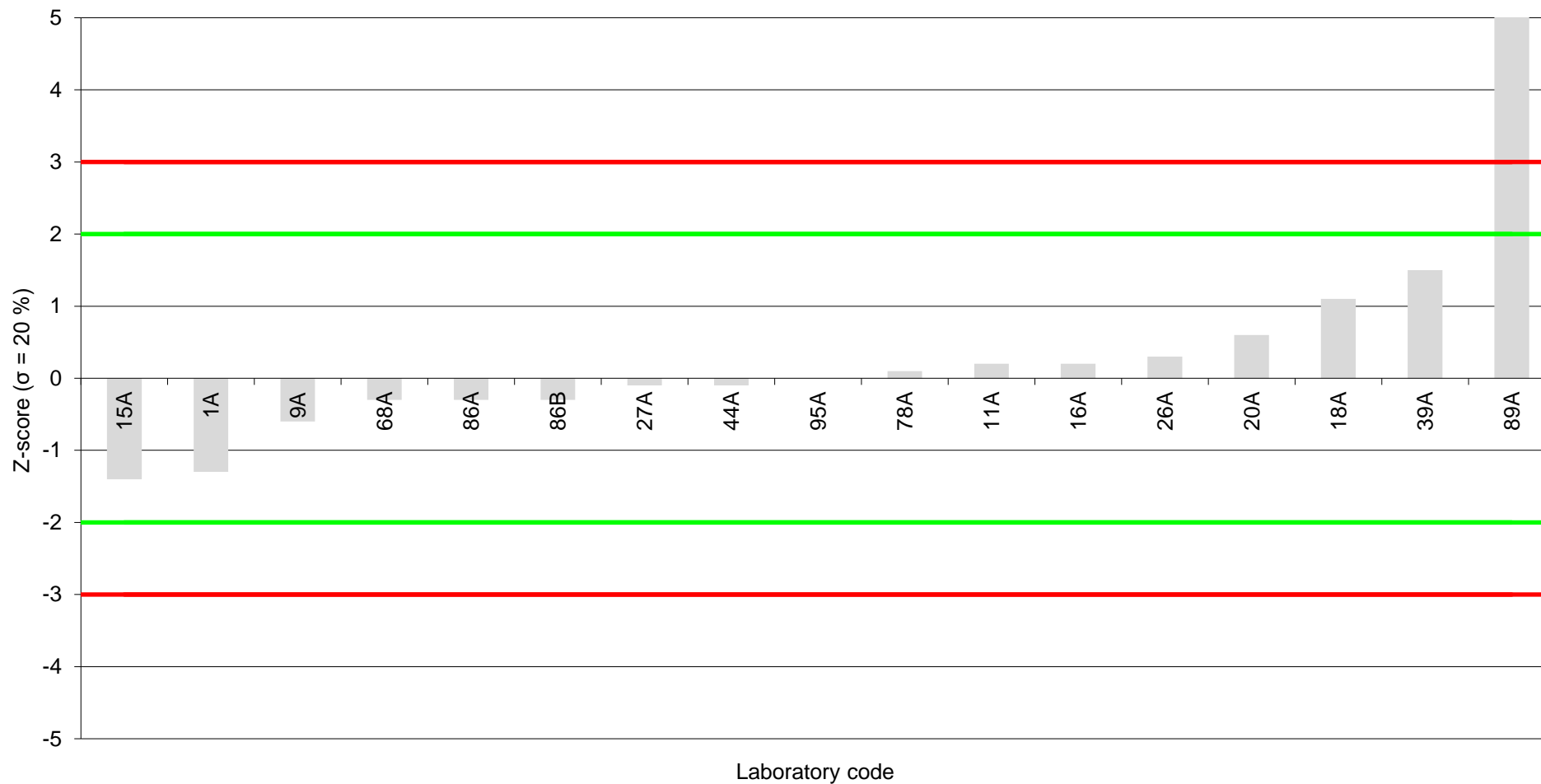
Hay (2502-HY)
Sum of α -, β -, γ -HBCDD lb
Assigned value: 1.07 $\mu\text{g}/\text{kg}$ product (12 % moisture content)



Hay (2502-HY)

(+/-)- α -HBCDD

Assigned value: 0.107 $\mu\text{g}/\text{kg}$ product (12 % moisture content)



Hay (2502-HY)

(+/-)- γ -HBCDD

Assigned value: 0.969 $\mu\text{g}/\text{kg}$ product (12 % moisture content)





EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

25 June 2026

Annex 11: Participants' methods for HBCDDs

Test sample - Hay (2502-HY)

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

Hay (2502-HY)

Methods HBCDDs - Accreditation, weighed sample, standards

LC	Data set	Sample	Accreditation according to ISO/IEC 17025	Weighed sample [g]	Use of isotope-labelled internal standards HBCDD diastereomers (yes/no)
1	A	2502-HY	yes	9	yes
2		2502-HY			
3		2502-HY			
4		2502-HY			
5		2502-HY			
6		2502-HY			
7		2502-HY			
8		2502-HY			
9	A	2502-HY		5.18	
10		2502-HY			
11	A	2502-HY	yes	10	yes
12		2502-HY			
13		2502-HY			
14		2502-HY			
15		2502-HY			
16	A	2502-HY	no	10	yes
17		2502-HY			
18	A	2502-HY	no	10	yes
19		2502-HY			
20	A	2502-HY	yes	10	yes
21		2502-HY			
22		2502-HY			
23		2502-HY			
24		2502-HY			
25		2502-HY			
26	A	2502-HY	yes	3	yes
27	A	2502-HY	yes	5	yes
28		2502-HY			
29		2502-HY			
30		2502-HY			
31		2502-HY			
32		2502-HY			
33		2502-HY			
34		2502-HY			
35		2502-HY			
36	A	2502-HY	no	2	yes
37		2502-HY			
38		2502-HY			
39	A	2502-HY	no	25.8739	yes
40		2502-HY			
41		2502-HY			
42		2502-HY			
43		2502-HY			
44	A	2502-HY	no	10	yes
45		2502-HY			
46		2502-HY			
47		2502-HY			
48		2502-HY			
49		2502-HY			
50		2502-HY			
51		2502-HY			
52		2502-HY			
53		2502-HY			
54		2502-HY			
55		2502-HY			
56		2502-HY			
57		2502-HY			

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

Hay (2502-HY)

Methods HBCDDs - Accreditation, weighed sample, standards

LC	Data set	Sample	Accreditation according to ISO/IEC 17025	Weighed sample [g]	Use of isotope-labelled internal standards HBCDD diastereomers (yes/no)
58		2502-HY			
59		2502-HY			
60		2502-HY			
61		2502-HY			
62		2502-HY			
63		2502-HY			
64		2502-HY			
65		2502-HY			
66		2502-HY			
67		2502-HY			
68	A	2502-HY	yes	10	yes
69		2502-HY			
70		2502-HY			
71		2502-HY			
72		2502-HY			
73		2502-HY			
74		2502-HY			
75		2502-HY			
76		2502-HY			
77		2502-HY			
78	A	2502-HY	no	9	yes
79		2502-HY			
80		2502-HY			
81		2502-HY			
82		2502-HY			
83		2502-HY			
84		2502-HY			
85		2502-HY			
86	A	2502-HY	yes	5	yes
87		2502-HY			
88		2502-HY			
89	A	2502-HY	no	2	yes
90		2502-HY			
91		2502-HY			
92		2502-HY			
93		2502-HY			
94		2502-HY			
95	A	2502-HY	yes	5.03	
96		2502-HY			
97		2502-HY			
Additional Sets					
86	B	2502-HY	no	5	yes

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)

Methods HBCDDs - Internal and recovery standards

LC	Data set	Sample	(+/-)- α -HBCDD Internal standard	(+/-)- β -HBCDD Internal standard	(+/-)- γ -HBCDD Internal standard	(+/-)- α -HBCDD Recovery standard	(+/-)- β -HBCDD Recovery standard	(+/-)- γ -HBCDD Recovery standard
1	A	2502-HY	13C-alpha-HBCDD	13C-beta-HBCDD	13C-gamma-HBCDD	D18-beta-HBCDD	D18-beta-HBCDD	D18-beta-HBCDD
2		2502-HY						
3		2502-HY						
4		2502-HY						
5		2502-HY						
6		2502-HY						
7		2502-HY						
8		2502-HY						
9	A	2502-HY	13C12-alpha-HBCD	13C12-beta-HBCD	13C12-gamma-HBCD	d18-beta-HBCD	d18-beta-HBCD	d18-beta-HBCD
10		2502-HY						
11	A	2502-HY						
12		2502-HY						
13		2502-HY						
14		2502-HY						
15		2502-HY	13C12- α -HBCDD	13C12- β -HBCDD	13C12- γ -HBCDD	NA	NA	NA
16	A	2502-HY	α -HBCD	β -HBCD	γ -HBCD	D18- β -HBCD	D18- β -HBCD	D18- β -HBCD
17		2502-HY						
18	A	2502-HY	13C α -HBCDD	13C β -HBCDD	13C γ -HBCDD			
19		2502-HY						
20	A	2502-HY	13C-A-HBCD	13C-B-HBCD	13C-Y-HBCD	RS-D18-B-HBCD	RS-D18-B-HBCD	RS-D18-B-HBCD
21		2502-HY						
22		2502-HY						
23		2502-HY						
24		2502-HY						
25		2502-HY						
26	A	2502-HY	13C- α -HBCDD	13C- β -HBCDD	13C- γ -HBCDD	d18- β -HBCDD	d18- β -HBCDD	d18- β -HBCDD
27	A	2502-HY	(13C12)- α -HBCDD	(13C12)- β -HBCDD	(13C12)- γ -HBCDD			
28		2502-HY						
29		2502-HY						
30		2502-HY						
31		2502-HY						
32		2502-HY						
33		2502-HY						
34		2502-HY						
35		2502-HY						
36	A	2502-HY	alpha-HBCDD (13C)	beta-HBCDD (13C)	gamma-HBCDD (13C)		D18-beta-HBCDD	
37		2502-HY						
38		2502-HY						
39	A	2502-HY	13C- α -HBCD	13C- β -HBCD	13C- γ -HBCD	13C- δ -HBCD	13C- δ -HBCD	13C- δ -HBCD
40		2502-HY						
41		2502-HY						
42		2502-HY						
43		2502-HY						
44	A	2502-HY	13C12-alpha-HBCDD	13C12-beta-HBCDD	13C12-gamma-HBCDD	alpha-HBCDD-d18	beta-HBCDD-d18	gamma-HBCDD-d18
45		2502-HY						
46		2502-HY						
47		2502-HY						
48		2502-HY						
49		2502-HY						
50		2502-HY						
51		2502-HY						
52		2502-HY						
53		2502-HY						
54		2502-HY						
55		2502-HY						
56		2502-HY						
57		2502-HY						
58		2502-HY						

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)

Methods HBCDDs - Internal and recovery standards

LC	Data set	Sample	(+/-)- α -HBCDD Internal standard	(+/-)- β -HBCDD Internal standard	(+/-)- γ -HBCDD Internal standard	(+/-)- α -HBCDD Recovery standard	(+/-)- β -HBCDD Recovery standard	(+/-)- γ -HBCDD Recovery standard
59		2502-HY						
60		2502-HY						
61		2502-HY						
62		2502-HY						
63		2502-HY						
64		2502-HY						
65		2502-HY						
66		2502-HY						
67		2502-HY						
68	A	2502-HY	13Calfa	13Cbeta	13Cgama	dbhbcdd	dbhbcdd	dbhbcdd
69		2502-HY						
70		2502-HY						
71		2502-HY						
72		2502-HY						
73		2502-HY						
74		2502-HY						
75		2502-HY						
76		2502-HY						
77		2502-HY						
78	A	2502-HY	13C alphaHBCDD	13C betaHBCDD	13C gammaHBCDD	d18-racbeta-1,2,5,6,9,10 - Hexabromocyklododecane	d18-racbeta-1,2,5,6,9,10 - Hexabromocyklododecane	d18-racbeta-1,2,5,6,9,10 - Hexabromocyklododecane
79		2502-HY						
80		2502-HY						
81		2502-HY						
82		2502-HY						
83		2502-HY						
84		2502-HY						
85		2502-HY						
86	A	2502-HY	α -HBCD-13C12	γ -HBCD-13C12	γ -HBCD-13C12	β -HBCD-13C12	β -HBCD-13C12	β -HBCD-13C12
87		2502-HY						
88		2502-HY						
89	A	2502-HY	alpha HBCD 13C12	alpha HBCD 13C12	gamma HBCD D18	no	no	no
90		2502-HY						
91		2502-HY						
92		2502-HY						
93		2502-HY						
94		2502-HY						
95	A	2502-HY	13C12-alpha-HBCD	13C12-beta-HBCD	13C12-gamma-HBCD	d18-gamma-HBCD	d18-gamma-HBCD	d18-gamma-HBCD
96		2502-HY						
97		2502-HY						
Additional Sets								
86	B	2502-HY	α -HBCDD-13C12	γ -HBCDD-13C12	γ -HBCDD-13C12	β -HBCD-13C12	β -HBCD-13C12	β -HBCD-13C12

Hay (2502-HY)

Methods HBCDDs - Extraction

LC	Data set	Sample	Extraction					
			Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [°C]	Extraction pressure [MPa]
1	A	2502-HY		Twisselmann	Ethanol / Toluene (70:30, v/v)	6 h	boiling point	
2		2502-HY						
3		2502-HY						
4		2502-HY						
5		2502-HY						
6		2502-HY						
7		2502-HY						
8		2502-HY						
9	A	2502-HY		QuECHERS		1		
10		2502-HY						
11	A	2502-HY		Soxhlet	toluene/acetone 7/3	6		
12		2502-HY						
13		2502-HY						
14		2502-HY						
15		2502-HY						
16	A	2502-HY		Pressurized liquid extraction	Hexane/Acetone (70:30)	1	125	10.3
17		2502-HY						
18	A	2502-HY		Pressurized liquid extraction	toluene:ethanol	0,25	120	100
19		2502-HY						
20	A	2502-HY		ASE	Acetone/Hexane 50/50	0.5	100	10.3
21		2502-HY						
22		2502-HY						
23		2502-HY						
24		2502-HY						
25		2502-HY						
26	A	2502-HY		Pressurized liquid extraction	Toluene / Acetone (70 / 30)	1	120	10
27	A	2502-HY		Cold extraction	shaking with dichlormethane : acetone 2:1	1.5	ambient	ambient
28		2502-HY						
29		2502-HY						
30		2502-HY						
31		2502-HY						
32		2502-HY						
33		2502-HY						
34		2502-HY						
35		2502-HY						
36	A	2502-HY		Mechanical shaking	Hexane/Dichloromethane (50/50)	0.33	20	Ambiant
37		2502-HY						
38		2502-HY						
39	A	2502-HY		Soxhlet	toluene/ethanol 50/50	24	120	0.1013
40		2502-HY						
41		2502-HY						
42		2502-HY						
43		2502-HY						
44	A	2502-HY		Randall	Hexane / Dichloromethan / Ethanol 5 / 2 / 1	1.5	95	atmosphere
45		2502-HY						
46		2502-HY						
47		2502-HY						
48		2502-HY						
49		2502-HY						
50		2502-HY						
51		2502-HY						
52		2502-HY						
53		2502-HY						
54		2502-HY						
55		2502-HY						
56		2502-HY						
57		2502-HY						

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]
 EURL for halogenated Persistent Organic Pollutants (POPs) in Feed and Food

Hay (2502-HY)
 Methods HBCDDs - Extraction

LC	Data set	Sample	Extraction					
			Sample preparation/pre-treatment	Extraction technique	Extraction solvent	Extraction time [h]	Extraction temperature [°C]	Extraction pressure [MPa]
58		2502-HY						
59		2502-HY						
60		2502-HY						
61		2502-HY						
62		2502-HY						
63		2502-HY						
64		2502-HY						
65		2502-HY						
66		2502-HY						
67		2502-HY						
68	A	2502-HY		Soxhlet	DCM:hex 1:1	6	80	room
69		2502-HY						
70		2502-HY						
71		2502-HY						
72		2502-HY						
73		2502-HY						
74		2502-HY						
75		2502-HY						
76		2502-HY						
77		2502-HY						
78	A	2502-HY		Pressurized liquid extraction	toluene/acetone	0,3	100	10
79		2502-HY						
80		2502-HY						
81		2502-HY						
82		2502-HY						
83		2502-HY						
84		2502-HY						
85		2502-HY						
86	A	2502-HY		QuEChERS like-extraction	Ethyl acetate			
87		2502-HY						
88		2502-HY						
89	A	2502-HY		QuECHERS	Acetonitrile	30 min	RT	
90		2502-HY						
91		2502-HY						
92		2502-HY						
93		2502-HY						
94		2502-HY						
95	A	2502-HY		QuECHERS				
96		2502-HY						
97		2502-HY						
Additional Sets								
86	B	2502-HY		QuEChERS like-extraction	Ethyl acetate			

Hay (2502-HY)
 Methods HBCDDs - Clean-up

LC	Data set	Sample	Clean-up										Any additional information (e.g. SPE column, dSPE)	Final volume [µl]: HBCDD
			Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Fully automated system	Semi-automated system	Solid Phase Extraction	Dispersive Solid Phase Extraction	Other columns / clean-up method (please specify)		
1	A	2502-HY	no	yes	yes	no	no		no	no	no			100
2		2502-HY												
3		2502-HY												
4		2502-HY												
5		2502-HY												
6		2502-HY												
7		2502-HY												
8		2502-HY												
9	A	2502-HY	no	no	no	no	no		no	no	no			10
10		2502-HY												
11	A	2502-HY	yes	no	no	no	no		no	yes	no	silica gel column	Florisil SPE	100
12		2502-HY												
13		2502-HY												
14		2502-HY												
15		2502-HY												
16	A	2502-HY	no	yes	no	no	no		no	no	no	acid hydrolysis with sulphuric acid		100
17		2502-HY												
18	A	2502-HY	no	yes	no	no	no		no	no	no			120
19		2502-HY												
20	A	2502-HY	no	yes	yes	no	no		no	no	no			100
21		2502-HY												
22		2502-HY												
23		2502-HY												
24		2502-HY												
25		2502-HY												
26	A	2502-HY	no	yes	no	no	no		no	no	no	liquid / liquid extraction silica + Na2SO4 column		50
27	A	2502-HY	yes	no	no	no	no		no	no	no			500
28		2502-HY												
29		2502-HY												
30		2502-HY												
31		2502-HY												
32		2502-HY												
33		2502-HY												
34		2502-HY												
35		2502-HY												
36	A	2502-HY	no	yes	no	no	no		no	no	no			200
37		2502-HY												
38		2502-HY												
39	A	2502-HY	no	yes	no	no	no		no	no	no			1000
40		2502-HY												
41		2502-HY												
42		2502-HY												
43		2502-HY												
44	A	2502-HY	no	yes	no	no	no		no	no	no			400
45		2502-HY												
46		2502-HY												
47		2502-HY												
48		2502-HY												
49		2502-HY												
50		2502-HY												
51		2502-HY												
52		2502-HY												
53		2502-HY												
54		2502-HY												
55		2502-HY												
56		2502-HY												
57		2502-HY												
58		2502-HY												
59		2502-HY												
60		2502-HY												
61		2502-HY												
62		2502-HY												
63		2502-HY												
64		2502-HY												
65		2502-HY												
66		2502-HY												
67		2502-HY												
68	A	2502-HY	yes	yes	no	no	yes		yes	no	no			200
69		2502-HY												
70		2502-HY												
71		2502-HY												
72		2502-HY												
73		2502-HY												

Hay (2502-HY)
 Methods HBCDDs - Clean-up

LC	Data set	Sample	Clean-up										Any additional information (e.g. SPE column, dSPE)	Final volume [µl]: HBCDD	
			Gelchromatography	Silica/sulfuric acid column	Florisil column	Alumina column	Carbon column	Fully automated system	Semi-automated system	Solid Phase Extraction	Dispersive Solid Phase Extraction	Other columns / clean-up method (please specify)			
74		2502-HY													
75		2502-HY													
76		2502-HY													
77		2502-HY													
78	A	2502-HY	no	yes	no	no	no	no	no	no	no				50
79		2502-HY													
80		2502-HY													
81		2502-HY													
82		2502-HY													
83		2502-HY													
84		2502-HY													
85		2502-HY													
86	A	2502-HY	no	yes	no	no	no	no	no	no	no	d-SPE on Agilent EMR dispersive kit			250
87		2502-HY													
88		2502-HY													
89	A	2502-HY	no	no	no	no	no	no	no	no	no	liquid-liquid partition (water-cyclohexane)			200
90		2502-HY													
91		2502-HY													
92		2502-HY													
93		2502-HY													
94		2502-HY													
95	A	2502-HY	no	yes	no	no	no	no	no	no	no				1000
96		2502-HY													
97		2502-HY													
Additional Sets															
86	B	2502-HY	no	yes	no	no	no	no	no	no	no	d-SPE on Agilent EMR dispersive kit			250

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Methods HBCDDs - Detection, LOQ, measurement uncertainty

LC	Data set	Sample	Chromatographic separation and detection method				Detector	Limit of quantification Determination of LOQ	Measurement uncertainty Estimation
			Chromatographic separation	Injection	Injected volume [µl]	Chromatographic separation: Stationary phase			
1	A	2502-HY	LC		2	C18	MS/MS	lowest validated level	expanded MU according to EURL
2		2502-HY							
3		2502-HY							
4		2502-HY							
5		2502-HY							
6		2502-HY							
7		2502-HY							
8		2502-HY							
9	A	2502-HY	LC	1.00		2 times higher then Blanks and S/N over 10		no	no
10		2502-HY							
11	A	2502-HY	LC			RP 18	MS/MS		
12		2502-HY							
13		2502-HY							
14		2502-HY							
15		2502-HY							
16	A	2502-HY	LC		5	BEH C18 (50x2.1 mm)	HRMS	The LOQ was estimated following the "Calibration Standards" approach. This methodology is reported in the Guidance Document on the Estimation of LOD and LOQ for Measurements in the Field of Contaminants in Feed and Food.	The MU was estimated using the Top-Down approach reported in the Guidance Document on Measurement Uncertainty for Laboratories performing PCDD/F and PCB Analysis using Isotope Dilution Mass Spectrometry
17		2502-HY							
18	A	2502-HY	LC	Direct	8	C18	MS/MS	0.020 ng/g	40%. This is an estimation based on the methods performance with other matrix
19		2502-HY							
20	A	2502-HY	LC		10	C18	HRMS	Lowest validated level	RSS
21		2502-HY							
22		2502-HY							
23		2502-HY							
24		2502-HY							
25		2502-HY							
26	A	2502-HY	LC		3	Hypersil Gold	MS/MS	S/N = 10	
27	A	2502-HY	LC		10	C-18	MS/MS	spiking of matrix with low amount of analytes	based on validation - calculation from RSD and bias
28		2502-HY							
29		2502-HY							
30		2502-HY							
31		2502-HY							
32		2502-HY							
33		2502-HY							
34		2502-HY							
35		2502-HY							
36	A	2502-HY	LC	UPLC	5	Eclipse Plus C18, 2.1 x 100mm	MS/MS	Lowest point of validation	40% - This is the uncertainty measurement we use for accredited food samples. We are not accredited for feed matrices.
37		2502-HY							
38		2502-HY							
39	A	2502-HY	LC			Acquity BEH C18 150 mm	MS/MS		
40		2502-HY							
41		2502-HY							
42		2502-HY							
43		2502-HY							
44	A	2502-HY	LC		15	C18	MS/MS	ten point equidistant calibration in Matrix at the expected LOQ using DIN 32645	
45		2502-HY							
46		2502-HY							
47		2502-HY							
48		2502-HY							
49		2502-HY							
50		2502-HY							
51		2502-HY							
52		2502-HY							
53		2502-HY							
54		2502-HY							

EURL Proficiency Study on the Determination of PCDD/Fs, PCBs, PBDEs, HBCDDs and PFAS in Hay 2025 [EURL-PT-POP_2502-HY]

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

Hay (2502-HY)

Methods HBCDDs - Detection, LOQ, measurement uncertainty

LC	Data set	Sample	Chromatographic separation and detection method			Detector	Limit of quantification Determination of LOQ	Measurement uncertainty Estimation	
			Chromatographic separation	Injection	Injected volume [µl]				Chromatographic separation: Stationary phase
55		2502-HY							
56		2502-HY							
57		2502-HY							
58		2502-HY							
59		2502-HY							
60		2502-HY							
61		2502-HY							
62		2502-HY							
63		2502-HY							
64		2502-HY							
65		2502-HY							
66		2502-HY							
67		2502-HY							
68	A	2502-HY	LC		70	Luna php	MS/MS	0.01 (lowest spiked level reaching requirements laid down in EURL recommendations)	taking into account uncertainty from bias and RSD under reproducibility conditions and rounding up
69		2502-HY							
70		2502-HY							
71		2502-HY							
72		2502-HY							
73		2502-HY							
74		2502-HY							
75		2502-HY							
76		2502-HY							
77		2502-HY							
78	A	2502-HY	LC		10	Hypersil Gold C18, 100x2,1mm, 1,9µm	MS/MS	LOD and LOQ were estimated based on analysis of 10 blank spiked samples	MU were estimated based on precision and truenes from fortyfication experiment
79		2502-HY							
80		2502-HY							
81		2502-HY							
82		2502-HY							
83		2502-HY							
84		2502-HY							
85		2502-HY							
86	A	2502-HY	LC		20	KINETEX 2.6um XB-C18 100A (100 x 2.1 mm) (PHENOMENEX)	MS/MS	0.050 µg/kg determined by fortified samples	Nordtest
87		2502-HY							
88		2502-HY							
89	A	2502-HY	LC	sample loop	5	cyclodextrine	MS/MS	10>1 signal to noise at spiked samples	multiple measurement with reference material RSD x 2
90		2502-HY							
91		2502-HY							
92		2502-HY							
93		2502-HY							
94		2502-HY							
95	A	2502-HY	LC		10		MS/MS	2 times higher than Blanks and S/N over 10	profficiency testings and spiked samples
96		2502-HY							
97		2502-HY							
Additional Sets									
86	B	2502-HY	LC		20	KINETEX 2.6um XB-C18 100A (100 x 2.1 mm) (PHENOMENEX)	MS/MS	0.050 µg/kg determined by fortified samples	Nordtest