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National Measurement Institute

# Proficiency Test Final Report
# AQA 25-10
# PFAS in Soil and Biosolids

March 2026

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## SUMMARY

AQA 25-10 PFAS in Soil and Biosolids was designed based on USEPA Method 1633A requirements and participants' feedback and was focused on the measurement of 42 per- and polyfluoroalkyl substances (PFAS): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFNA, PFDA, PFUdA, PFDoA, PFTrDA, PFTeDA, PFHxDA, PFODA, PFBS, PFPeS, total PFHxS, linear PFHxS, PFHpS, total PFOS, linear PFOS, PFNS, PFDS, PFUdS, PFDoS, PFTrDS, PFOSA, EtFOSA, MeFOSAA, EtFOSAA, MeFOSE, 6:2FTS, 10:2FTS, 6:2diPAP, 8:2diPAP, 6:2FTOH, 3:3FTCA, 5:3FTCA, GenX, ADONA, PFMPA, 11Cl-PF3OUdS, and PFEESA in soil and biosolids.

Thirty-seven laboratories registered to participate, and all participants submitted results.

Three test samples were prepared at the NMIA North Ryde laboratory and consisted of:

- two soil samples: Sample S1 with incurred PFAS contaminants, and Sample S2 spiked with 30 individual PFAS analytes; and
- one moist biosolids sample (S3), spiked with 25 individual PFAS analytes.

The assigned values for all scored analytes were the robust averages of participants' results, and associated uncertainties were evaluated from the robust standard deviations.

**Traceability**: The consensus of participants' results is not traceable to any external reference, so although expressed in SI units, metrological traceability has not been established.

The outcomes of the study were assessed against the aims as follows, to:

*i. assess laboratory capability to correctly identify PFAS in soil and biosolids;*

No participant reported numeric results for all 78 analytes assessed across the three samples.

Twenty-three participants did not report numeric results for analytes that they tested for and that were spiked into the samples (total of 143 results).

Twenty-six laboratories reported at least one PFAS analyte that was not spiked into the test samples.

*ii. compare the performances of participants and assess their capability in the measurement of PFAS in soil and biosolids;*

Of 1411 $z$-scores, 1232 (87%) returned $|z| \leq 2.0$, indicating an acceptable performance.

Of 1405 $E_n$-scores, 1110 (79%) returned $|E_n| < 1.0$, indicating agreement of the participant's result with the assigned value within their respective expanded uncertainties.

Laboratory **27** reported results for all analytes for which $z$-scores were calculated (61) and Laboratory **19** returned the highest number of acceptable $z$-scores (56). All results reported by Laboratories **12** (53), **5** (49), **9** (47), **31** (35), **35** (35), **2** (33), **16** (25), **10** (24), **8** (17), **3** (16), **11** (13), and **15** (3) returned acceptable $z$-scores.

Laboratory **34** had the highest number of acceptable $E_n$-scores (54). Laboratories **3**, **5**, **8**, **11**, **15**, **17**, and **35** returned acceptable $E_n$-scores for all scored analytes.

*iii. evaluate laboratories' methods used in determination of PFAS in soil and biosolids analysis;*

Measurements of PFAS analytes in the incurred soil sample S1 and biosolids sample S3 challenged more participants' analytical techniques than the spiked soil sample S2.

A relationship between low-biased results reported for long-chain PFAS (>C8) and PFAA in soil and biosolids, and the use of acetonitrile (ACN) as an extraction reagent, was evident. These PFAS compounds bind strongly to soil organic matter and mineral surfaces; they remain 'incorporated into soil matter' and are difficult to remove. Caution should be exercised when ACN is used as extraction reagent because it has limited ability to disrupt these strong hydrophobic/hydrophilic interactions. Strong solvent–matrix disruption like ASE, methanol and optimized conditions (e.g. high temperature) are required.

PFODA in Sample S2 could not be set an assigned value. Laboratories continue to experience difficulties in accurately quantifying this analyte in soil. The spiked value was 5.36 µg/kg; however, some laboratories reported results at less than half of this value or even below their reporting limits. Laboratories should review their methodology, as PFODA can be lost during extraction depending on the composition of the extraction solvent.

Consistent with previous studies, the PFNS and PFDS measurements in soil samples with high PFOS content remains problematic for laboratories that use PFOS as their mass-labelled internal standard for these tests.

Long chain PFSAs (>C8) were also challenging for participants analytical techniques. Except for PFUdS in Sample S2 (few reported numeric results), the results for most of these analytes were variable with robust between-laboratory CV ranging from 26% to 84%. Contributing factors may include challenging chromatographic behaviour, which show strong retention and sensitivity to slight changes in LC conditions, surface adsorption effects and limited availability of appropriate isotope-labelled internal standards.

This was the first NMIA PFAS in Soil study to include PFHxDA spiked into soil; of the 13 reported results, 12 were acceptable. This was also the first study to include 6:2FTOH in soil; only two laboratories reported numeric results for this test.

This is the second time that participants' performance in measuring PFAS in a biosolids matrix has been assessed. PFDoA, PFDoS, 6:2diPAP, 8:2diPAP, and 5:3FTCA continue to challenge participants' analytical techniques in this matrix.

The most popular method used for the biosolids sample analysis consisted of SLE extraction, a sample size smaller than previous study of 1-2 g, methanol base as extraction solvent, and SPE cleanup followed by LC MS/MS determination.

*iv. develop the practical application of measurement uncertainty and provide participants with information that will be useful evaluating their uncertainties;*

Of 1621 numerical results, 1502 (93%) were reported with an associated measurement uncertainty.

A large number of laboratories are still reporting unrealistically small or large relative uncertainties for routine PFAS. The magnitude of the reported expanded uncertainties was within the range 1% to 733% of the reported value. Additionally, some laboratories are still reporting numeric evaluations of uncertainties for non-numeric results.

*v. compare the performance of participants with their past performance;*

AQA 16-06 was conducted in 2016 and included 6 analytes in soil. Of the 93 results for which a z-score was calculated, 88 (95%) returned an acceptable z-score. The present study includes 50 tests over the two soil samples as well as 28 tests for the biosolids sample and has had 1411 numerical results reported for which a z-score was calculated.

Over the last 10 years laboratories have developed methods for the analysis of a wide spectrum of PFAS contaminants and in general the reported results are compatible, showing

that the mass-labelled standards are capable of correcting for the differences between these methods.

*vi. produce materials that can be used in method validation and as control samples.*

A reference material for PFAS analytes in soil (MX019) is available for sale from NMIA. (https://www.industry.gov.au/national-measurement-institute/nmi-services/chemical-and-biological-measurement-services/chemical-reference-materials/matrix-reference-materials).

Surplus test samples from the present study are also available for sale. The samples are homogeneous and well characterised from the results of the proficiency round.

# 1 INTRODUCTION

## 1.1 NMIA Proficiency Testing Program

The National Measurement Institute Australia (NMIA) is responsible for Australia's national measurement infrastructure, providing a range of services including a chemical proficiency testing program.

Proficiency testing (PT) is the: 'evaluation of participant performance against pre-established criteria by means of interlaboratory comparisons.'[1] NMIA PT studies target chemical testing in areas of high public significance such as trade, environment, law enforcement, and food safety. NMIA offers studies in:

- per- and polyfluoroalkyl substances in soil, biosolids, water, biota, food, and consumer goods;
- hydrocarbons, phenols, and other organic compounds in soil and water;
- pesticide residues in soil, water, fruit, vegetables, and herbs;
- metals in soil, water, food, filters, and paint;
- nutrients, anions, and physical tests in water and soil;
- chlorophyll a in water; and
- controlled drug assay, drugs in wipes, and clandestine laboratory.

## 1.2 Study Aims

The aims of the study were to:

- assess laboratory capability in correctly identifying PFAS in soil and biosolids;
- compare the performances of participants and assess their capabilities in the measurement of PFAS in soil and biosolids;
- evaluate laboratories' methods used in the determination of PFAS in soil and biosolids analysis;
- develop the practical application of measurement uncertainty and provide participants with information that will be useful in evaluating their uncertainties;
- compare the performance of participants with their past performance; and
- produce materials that can be used in method validation and as control samples.

## 1.3 Study Conduct

The conduct of NMIA proficiency tests is described in the NMIA Study Protocol for Proficiency Testing.[2] The statistical methods used are described in the NMIA Chemical Proficiency Testing Statistical Manual.[3] These documents have been prepared with reference to ISO/IEC 17043[1] and The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories.[4]

NMIA is accredited by the National Association of Testing Authorities, Australia (NATA) to ISO/IEC 17043:2023 as a provider of proficiency testing schemes.[1] This study falls within the scope of NMIA's accreditation (Accreditation No. 198; Site No. 14485).

## 2 STUDY INFORMATION

### 2.1 Study Timetable

The timetable of the study was:

| | |
|---|---|
| Invitation issued | 10 June 2025 |
| Samples dispatched | 25 August 2025 |
| Results due | 17 October 2025 |
| Interim report issued | 22 October 2025 |
| Preliminary report issued | 23 October 2025 |

### 2.2 Participation and Laboratory Code

Thirty-seven laboratories registered to participate in this study, and all submitted results by the results due date. All were assigned a confidential laboratory code number for this study.

### 2.3 Selection of PFAS Analytes and Test Material Preparation

Participants were provided with a list of potential PFAS analytes that were spiked into the study's samples, as presented in Table 1.

Table 1 Potential Spiked PFAS Analytes

| | | | | |
|---|---|---|---|---|
| PFBA | PFHxDA | PFDS | 4:2FTS | 7:3FTCA |
| PFPeA | PFODA | PFUdS | 6:2FTS | GenX |
| PFHxA | FOUEA | PFDoS | 8:2FTS | ADONA |
| PFHpA | PFBS | PFTrDS | 10:2FTS | PFMPA |
| PFOA | PFPeS | PFOSA | 6:2diPAP | PFMBA |
| PFNA | PFHxS (total) | N-MeFOSA | 8:2diPAP | NFDHA |
| PFDA | PFHxS (linear) | N-EtFOSA | 6:2FTOH | 9Cl-PF3ONS |
| PFUdA | PFHpS | N-MeFOSAA | 8:2FTOH | 11Cl-PF3OUdS |
| PFDoA | PFOS (total) | N-EtFOSAA | 10:2FTOH | PFEESA |
| PFTrDA | PFOS (linear) | N-MeFOSE | 3:3FTCA | PFECHS |
| PFTeDA | PFNS | N-EtFOSE | 5:3FTCA | |

Three test samples were provided for analysis:

- Two soil samples S1 and S2 each containing 20 g:
    - Sample S1 containing incurred PFAS analytes; and
    - Sample S2 spiked with 30 individual PFAS analytes.
- One biosolids sample S3 containing 20 g of autoclaved, moist biosolids spiked with 25 individual PFAS analytes.

Details of the spiked analytes and levels are presented in Table 2 and sample preparation details in Appendix 1.

The analytical standards used for spiking these samples were purchased from Toronto Research Chemicals and Wellington Laboratories Canada.

Table 2 Spiked Values of Test Samples

| PFAS | S2 Soil (Spiked) µg/kg | S3 Biosolids (Spiked) µg/kg |
|---|---|---|
| PFBA | 1.96 | 11.1** |
| PFPeA | 2.44 | 5.11 |
| PFHxA | Not Spiked | 4.78** |
| PFHpA | 1.62 | 3.14 |
| PFOA | 2.45 | 8.29 |
| PFNA | 1.86 | 5.15 |
| PFDA | Not Spiked | 11.0** |
| PFUdA | 4.41 | Not Spiked |
| PFTrDA | Not Spiked | 13.6 |
| PFTeDA | 0.735 | 17.9** |
| PFHxDA | 9.80 | Not Spiked |
| PFODA | 5.36 | Not Spiked |
| PFBS* | 1.95 | 6.22 |
| PFHxS* | 1.72 | 2.98** |
| PFHxS_L* | 1.39 | 2.55** |
| PFHpS* | Not Spiked | 10.3 |
| PFOS* | 5.91 | 11.5** |
| PFOS_L* | 4.66 | 9.05** |
| PFNS* | Not Spiked | 1.18 |
| PFDS* | Not Spiked | 30.7 |
| PFUdS* | 19.6 | Not Spiked |
| PFDoS* | 14.8 | 30.9 |
| PFTrDS* | 14.6 | Not Spiked |
| PFOSA | 0.980 | 5.15 |
| EtFOSA | 3.43 | Not Spiked |
| MeFOSAA | 4.90 | Not Spiked |
| EtFOSAA | Not Spiked | 20.5 |
| MeFOSE | 4.90 | Not Spiked |
| 6:2FTS* | 1.95 | 5.17 |
| 10:2FTS* | 49.1 | Not Spiked |
| 8:2diPAP | 4.90 | 23.0 |
| 6:2FTOH | 9.80 | Not Spiked |
| 3:3FTCA | 34.3 | Not Spiked |
| GenX | 14.7 | 41.1 |
| ADONA* | Not Spiked | 36.1 |
| PFMPA | 29.4 | Not Spiked |
| 11Cl-PF3OUdS* | 4.92 | 18.7 |
| PFEESA | 4.91 | Not Spiked |

*Values for these analytes are the anion concentration. **The spiked value includes the incurred value.

### 2.4 Homogeneity and Stability of Test Materials

The preparation of the study samples is described in Appendix 1. No homogeneity or stability testing was conducted on the study samples. These samples were prepared, stored and packaged using a process that has been demonstrated to produce homogeneous and stable samples in previous NMIA PFAS proficiency testing studies. Participants' results gave no reason to question the homogeneity and stability of previously used analytes.

### 2.5 Test Material Storage and Dispatch

Before dispatch, soil samples were refrigerated at 4ºC, while the biosolids samples were stored frozen at -20ºC.

The samples were packed into polystyrene foam boxes with cooler bricks and sent by courier on 25 August 2025.

The following items were packaged with the samples: a covering letter which included a description of the test samples and instructions for participants, and a form for participants to confirm the receipt and condition of the samples.

### 2.6 Instructions to Participants

Participants were instructed as follows:

- Quantitatively analyse the samples using your routine test method.
- Report results in units of µg/kg on an as received basis for Samples S1 and S2 (soil), and for Sample S3 (moist biosolids).
- To avoid loss of moisture, do not leave the moist biosolids sample S3 uncovered. Mix well before subsampling.
- If analyses cannot be commenced on the day of receipt, please store S1 and S2 chilled and S3 frozen.
- The PFAS analytes that may be present in the samples were given in a list. Participants could elect not to test for all listed analytes.
- Report results using the electronic results sheet emailed to you.
- For each analyte, report a single result expressed as if reporting to a client (i.e. corrected for recovery or not, according to your standard procedure, but state if results are corrected on the result sheet). This figure will be used in all statistical analysis in the study report.
- For each analyte report the associated expanded measurement uncertainty (e.g. 0.535 ± 0.023 µg/kg), if determined.
- No limit of reporting has been set for this study. Report results as you would to a client, applying the limit of reporting of the method used for analysis.
- Report any listed analyte not tested as NT.
- Please complete the method details and report the basis of your uncertainty evaluations as required by the results sheet.
- If determined, report your internal standard percentage recovery. This will be presented in the report for information only.
- Return the completed results sheet by email (proficiency@measurement.gov.au) by 3 October 2025.

The results due date was extended to 17 October 2025 due to shipping delays and instrumentation issues experienced by some participants.

### 2.7 Interim Report and Preliminary Report

An Interim Report was emailed to all participants on 22 October 2025.

A Preliminary Report was emailed to all participants on 23 October 2025. This report included: a summary of results reported by all laboratories, assigned values, performance coefficients of variation, *z*-scores and $E_n$-scores for each analyte tested by participants.

No data from the Preliminary Report has been changed in this Final Report.

## 3 PARTICIPANT LABORATORY INFORMATION

### 3.1 Test Methods Reported by Participants

Participants were requested to provide methodology information. Responses are presented in Appendix 6 for soil and biosolids. The study coordinator thanks participants for completing the questionnaire.

### 3.2 Basis of Participants' Measurement Uncertainty Evaluations

Participants were requested to provide information about their basis of measurement uncertainty (MU). This is presented in Tables 3 and 4 (some responses have been modified so that participants cannot be identified).

Table 3 Basis of Participants' Uncertainty Evaluation

| Lab. Code | Approach to Evaluating MU | Information Sources for MU Evaluation* | | Guide Document for Evaluating MU |
|---|---|---|---|---|
| | | Precision | Method Bias | |
| 1** | Standard deviation of replicate analyses multiplied by 2 or 3<br>k = 2 | Control samples - SS | Recoveries of SS | Statistics and Chemometrics for Analytical Chemistry, Miller and Miller, 5th Edition |
| 2 | Bottom Up (ISO/GUM, fish bone/cause and effect diagram)<br>Coverage factor not reported | Control samples - CRM<br>Duplicate analysis<br>Instrument calibration | CRM<br>Instrument calibration<br>Recoveries of SS | Eurachem/CITAC Guide |
| 3 | Coverage factor not reported | Control samples - SS | Instrument calibration | |
| 4 | Standard deviation of replicate analyses multiplied by 2 or 3<br>Coverage factor not reported | Control samples - CRM<br>Duplicate analysis | CRM | |
| 5 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples<br>Duplicate analysis | CRM<br>Recoveries of SS<br>Standard purity | Nordtest Report TR537 |
| 6 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Laboratory bias from PT studies<br>Recoveries of SS<br>Standard purity | |
| 7 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Recoveries of SS<br>Standard purity | ISO/GUM |
| 8 | Coverage factor not reported | Control samples - SS | | |
| 9 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | | CRM<br>Instrument calibration<br>Recoveries of SS | Eurachem/CITAC Guide |
| 10 | Top Down - precision and evaluations of the method and | Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Recoveries of SS | Eurachem/CITAC Guide |

| Lab. Code | Approach to Evaluating MU | Information Sources for MU Evaluation* | | Guide Document for Evaluating MU |
|---|---|---|---|---|
| | | Precision | Method Bias | |
| | laboratory bias<br>Coverage factor not reported | | | |
| 11 | Professional judgment<br>k = 2 | Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Recoveries of SS | Measurement Uncertainty for Laboratories performing PCDD/F and PCB Analysis |
| 12 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | CRM | NMIA Uncertainty Course |
| 13 | Bottom Up (ISO/GUM, fish bone/cause and effect diagram)<br>k = 2 | Duplicate analysis | Recoveries of SS | ISO/GUM |
| 14 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - SS | | ISO/GUM |
| 15 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Duplicate analysis | Standard purity | Eurachem/CITAC Guide |
| 16 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - SS<br>Duplicate analysis | Recoveries of SS | ISO/GUM |
| 17 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples<br>Duplicate analysis | CRM<br>Recoveries of SS<br>Standard purity | Nordtest Report TR537 |
| 18 | Standard deviation of replicate analyses multiplied by 2 or 3<br>Coverage factor not reported | Control samples - SS | Recoveries of SS | |
| 19 | Standard deviation of replicate analyses multiplied by 2 or 3<br>Coverage factor not reported | Standard deviation from PT studies only<br>Control samples - SS<br>Duplicate analysis<br>Instrument calibration | Recoveries of SS | Eurachem/CITAC Guide |
| 20 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | | Eurachem/CITAC Guide |
| 21 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | CRM<br>Instrument calibration<br>Recoveries of SS | ISO/GUM |
| 22 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Laboratory bias from PT studies | |

| Lab. Code | Approach to Evaluating MU | Information Sources for MU Evaluation* | | Guide Document for Evaluating MU |
|---|---|---|---|---|
| | | Precision | Method Bias | |
| | | | Recoveries of SS<br>Standard purity | |
| 23 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples<br>Duplicate analysis<br>Instrument calibration | Instrument calibration<br>Recoveries of SS<br>Standard purity | Eurachem/CITAC Guide |
| 24 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - CRM<br>Duplicate analysis<br>Instrument calibration | CRM<br>Instrument calibration | Eurachem/CITAC Guide |
| 25 | Coverage factor not reported | | | |
| 27 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - SS | Recoveries of SS | Nordtest Report TR537 |
| 28 | Standard deviation of replicate analyses multiplied by 2 or 3<br>Coverage factor not reported | Control samples - SS<br>Duplicate analysis<br>Instrument calibration | CRM<br>Instrument calibration<br>Standard purity | NATA GAG Etimating and Reporting MU |
| 29 | Coverage factor not reported | Standard deviation from PT studies only | | Nordtest Report TR537 |
| | | | Recoveries of SS | |
| 30 | Coverage factor not reported | | | |
| 31 | Top Down - precision and evaluations of the method and laboratory bias<br>Coverage factor not reported | Control samples - CRM<br>Duplicate analysis | CRM | Eurachem/CITAC Guide |
| 32 | Coverage factor not reported | | | |
| 33 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples<br>Duplicate analysis<br>Instrument calibration | CRM<br>Instrument calibration<br>Recoveries of SS<br>Standard purity | NMIA Uncertainty Course |
| 34 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - SS | Recoveries of SS | Eurachem/CITAC Guide |
| 35 | Top Down - precision and evaluations of the method and laboratory bias<br>k = 2 | Control samples - SS<br>Duplicate analysis | Recoveries of SS | ISO/GUM |
| 36 | Standard deviation of replicate analyses multiplied by 2 or 3<br>k = 2 | Duplicate analysis | Instrument calibration<br>Standard purity | Eurachem/CITAC Guide |
| 37 | Top Down - reproducibility (standard deviation) from PT studies used directly<br>Coverage factor not reported | Duplicate analysis | CRM | ISO/GUM |

| Lab. Code | Approach to Evaluating MU | Information Sources for MU Evaluation* | | Guide Document for Evaluating MU |
|---|---|---|---|---|
| | | Precision | Method Bias | |
| 38 | k = 2 | Control samples - SS | CRM<br>Instrument calibration<br>Recoveries of SS<br>Standard purity | Executive Order on quality requirements for environmental measurements. |

*SS = Spiked Samples, RM = Reference Material, CRM = Certified Reference Material. **Additional Information in Table 4

Table 4 Uncertainty Evaluation Additional Information

| Lab. Code | Approach to Evaluating MU |
|---|---|
| 1 | Measurement Uncertainty (U) estimated from the standard deviation (u) of replicate recovery samples using the expression U = 2 x u |

### 3.3 Participants' Comments

Participants were invited to make comments for this PT study. Such feedback allows for the improvement of future studies. There were no comments made by participants in this study.

## 4 PRESENTATION OF RESULTS AND STATISTICAL ANALYSIS

### 4.1 Results Summary

Participant results are listed in Tables 5 to 82 with resultant summary statistics. Bar charts of results and performance scores are presented in Figures 2 to 79. An example chart with interpretation guide is shown in Figure 1.

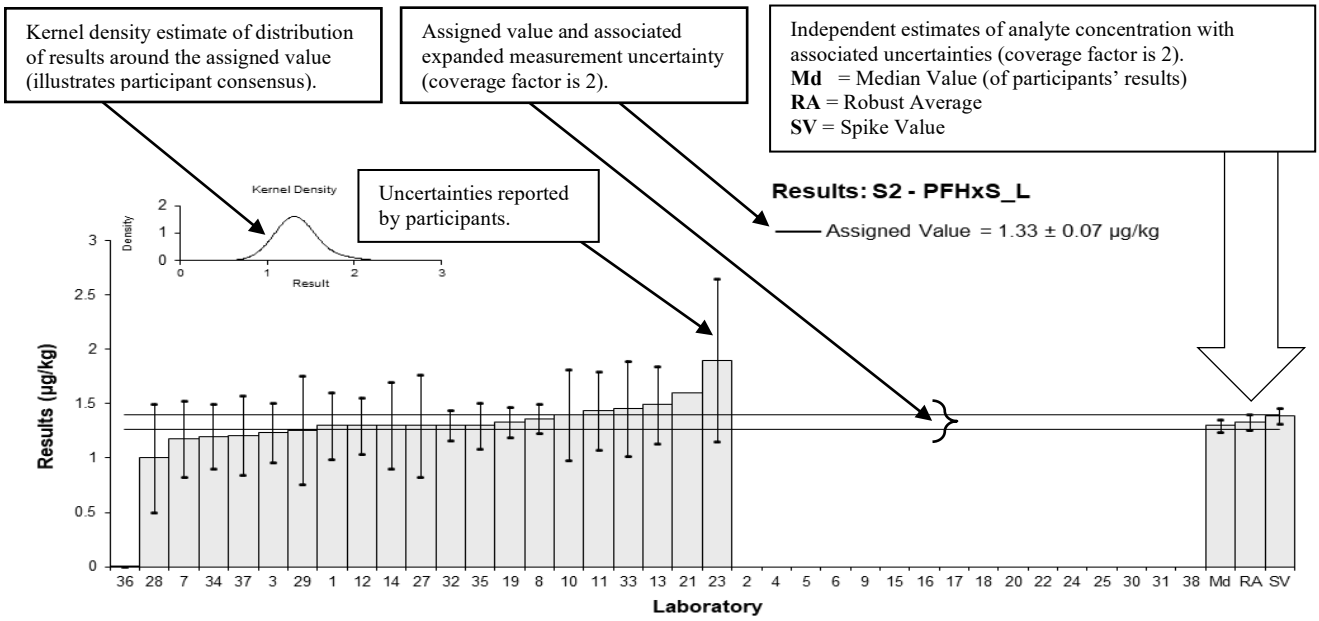



Figure 1 Guide to Presentation of Results

### 4.2 Outliers and Extreme Outliers

Outliers were results less than 50% and greater than 150% of the robust average and were removed before assigned value calculation. Extreme outliers (gross errors) were obvious blunders, such as those with incorrect units, decimal errors, or results from a different proficiency test item and were removed for calculation of summary statistics.[3-5]

### 4.3 Assigned Value

An example of the assigned value calculation using data from the present study is given in Appendix 2. The assigned value is defined as 'the value attributed to a particular property or characteristic of a proficiency testing item'.[1] In this study the property is the mass fraction of analyte. Assigned values were the robust average of participants' results, outliers removed; the expanded uncertainties were evaluated from the associated robust standard deviations.[4,5.]

### 4.4 Robust Average and Robust Between-Laboratory Coefficient of Variation

The robust averages and associated expanded uncertainties, and robust CVs (a measure of the variability of participants' results) were calculated as described in ISO 13528.[5]

Robust CV as presented in the Section 5 (Statistics table) is the robust between-laboratory CV including outliers but excluding extreme outliers. Everywhere else in the report, the robust between-laboratory CV refers to the robust CV calculated with both outliers and extreme outliers removed.

### 4.5 Standard Deviation for Proficiency Assessment

The standard deviation for proficiency assessment (SDPA, σ) is the product of the assigned value *(X)* and the performance coefficient of variation (PCV). This value is used for calculation of participant z-score and provides scaling for laboratory deviation from the assigned value.

$$\sigma = (X) \times \text{PCV} \qquad \text{Equation 1}$$

It is important to note that the PCV is a set value and is not the standard deviation of participants' results. The value set for PCV is based on the existing regulation, the acceptance criteria indicated by the methods, the matrix, the concentration level of analyte and on experience from previous studies. It is backed up by mathematical models such as the Thompson Horwitz equation.[6]

### 4.6 *z*-Score

An example of *z*-score calculation using data from the present study is given in Appendix 2. For each participant's result a *z*-score is calculated according to Equation 2 below:

$$z = \frac{(\chi - X)}{\sigma} \qquad \text{Equation 2}$$

where:

$z$ is *z*-score

$\chi$ is a participant's result

$X$ is the assigned value

$\sigma$ is the SDPA from Equation 1

For a z-score with absolute value (|z|): $|z| \leq 2.0$ is acceptable; $2.0 < |z| < 3.0$ is questionable; and $|z| \geq 3.0$ is unacceptable.

To account for potential low bias in consensus values due to inefficient methodologies, *z*-scores may be adjusted for a 'maximum acceptable result' (see also Section 6.3).

### 4.7 $E_n$-Score

An example of $E_n$-score calculation using data from the present study is given in Appendix 2. The $E_n$-score is complementary to the z-score in assessment of laboratory performance. $E_n$-score includes measurement uncertainty and is calculated according to Equation 3 below:

$$E_n = \frac{(\chi - X)}{\sqrt{U_\chi{}^2 + U_X{}^2}} \qquad \text{Equation 3}$$

where:

$E_n$ is $E_n$-score

$\chi$ is a participant's result

$X$ is the assigned value

$U_\chi$ is the expanded uncertainty of the participant's result;

$U_X$ is the expanded uncertainty of the assigned value.

For an $E_n$-score with absolute value ($|E_n|$): $|E_n| < 1.0$ is acceptable; and $|E_n| \geq 1.0$ is unacceptable.

### 4.8 Traceability and Measurement Uncertainty

Laboratories accredited to ISO/IEC Standard 17025[7] must establish and demonstrate the traceability and measurement uncertainty associated with their test results. Guidelines for quantifying uncertainty in analytical measurement are described in the Eurachem/CITAC Guide.[8]

## 5 TABLES AND FIGURES

Table 5

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFBA |
| **Unit** | µg/kg |

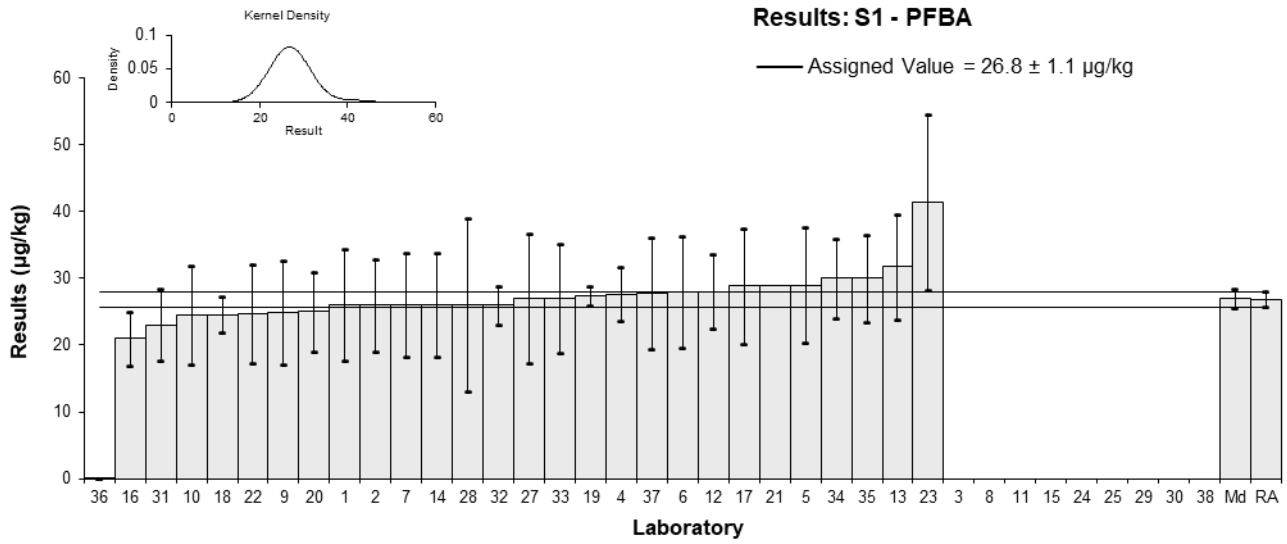
**Participant Results**

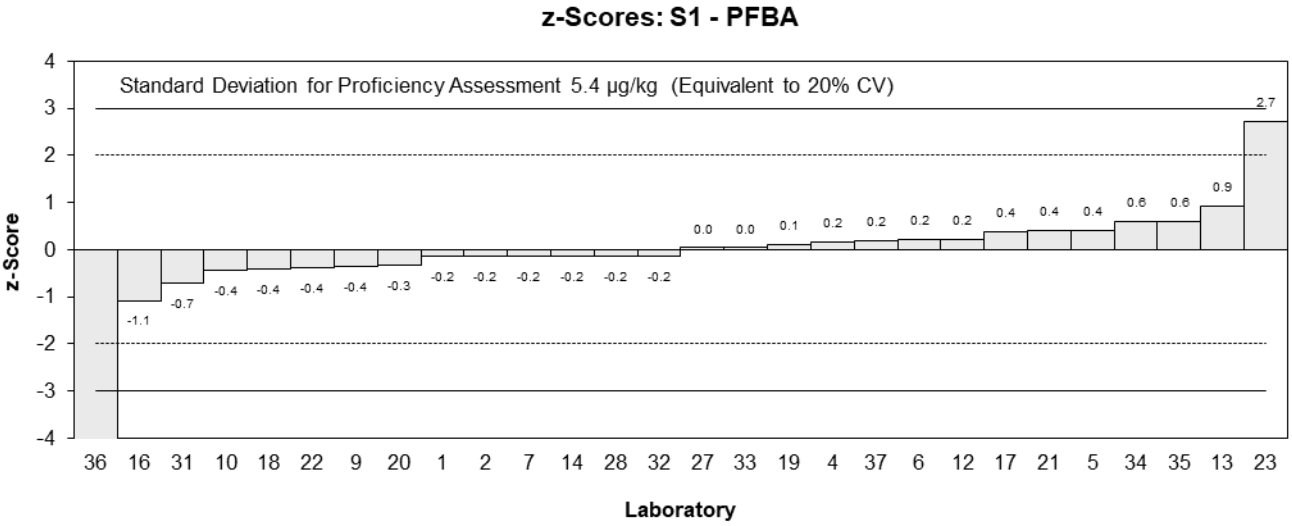
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 26 | 8.4 | 104 | -0.15 | -0.09 |
| **2** | 26 | 6.9 | NR | -0.15 | -0.11 |
| **3** | NT | NT | NT | | |
| **4** | 27.676 | 4.05 | 112 | 0.16 | 0.21 |
| **5** | 29.01177 | 8.703531 | 104 | 0.41 | 0.25 |
| **6** | 28 | 8.4 | 87 | 0.22 | 0.14 |
| **7** | 26 | 7.8 | NR | -0.15 | -0.10 |
| **8** | NS | NS | NS | | |
| **9** | 24.9 | 7.7 | 105 | -0.35 | -0.24 |
| **10** | 24.5 | 7.35 | 110 | -0.43 | -0.31 |
| **11** | NS | NS | NS | | |
| **12** | 28 | 5.6 | 102 | 0.22 | 0.21 |
| **13** | 31.79 | 7.9 | 87 | 0.93 | 0.63 |
| **14** | 26 | 7.8 | 106 | -0.15 | -0.10 |
| **15** | NS | NS | NS | | |
| **16** | 21 | 4 | NR | -1.08 | -1.40 |
| **17** | 28.91029 | 8.673087 | 88 | 0.39 | 0.24 |
| **18** | 24.6 | 2.7 | 63 | -0.41 | -0.75 |
| **19** | 27.4 | 1.38 | 71 | 0.11 | 0.34 |
| **20** | 25 | 6 | 130 | -0.34 | -0.30 |
| **21** | 29 | NR | 101 | 0.41 | 2.00 |
| **22** | 24.7 | 7.42 | 87 | -0.39 | -0.28 |
| **23*** | 41.4 | 13.2 | 96 | 2.72 | 1.10 |
| **24** | <49 | NR | 86.44 | | |
| **25** | <5 | NR | NR | | |
| **27** | 27 | 9.7 | NT | 0.04 | 0.02 |
| **28** | 26 | 13 | 87 | -0.15 | -0.06 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 23 | 5.38 | 110.87 | -0.71 | -0.69 |
| **32** | 26 | 2.9 | NR | -0.15 | -0.26 |
| **33** | 27.01 | 8.10 | 78 | 0.04 | 0.03 |
| **34** | 30 | 6 | 103 | 0.60 | 0.52 |
| **35** | 30 | 6.6 | 104.2 | 0.60 | 0.48 |
| **36**** | 0.0267 | 0.0016 | 89 | -5.00 | -24.34 |
| **37** | 27.81 | 8.34 | 82 | 0.19 | 0.12 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 26.8 | 1.1 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 26.9 | 1.2 |
| **Median** | 27.0 | 1.4 |
| **Mean** | 27.3 | |
| **N** | 27 | |
| **Max** | 41.4 | |
| **Min** | 21 | |
| **Robust SD** | 2.4 | |
| **Robust CV** | 8.9% | |


Kernel Density
Density
Result
Results: S1 - PFBA
Assigned Value = 26.8 ± 1.1 µg/kg
Results (µg/kg)
Laboratory
36 16 31 10 18 22 9 20 1 2 7 14 28 32 27 33 19 4 37 6 12 17 21 5 34 35 13 23 3 8 11 15 24 25 29 30 38 Md RA


z-Scores: S1 - PFBA
Standard Deviation for Proficiency Assessment 5.4 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 16 31 10 18 22 9 20 1 2 7 14 28 32 27 33 19 4 37 6 12 17 21 5 34 35 13 23

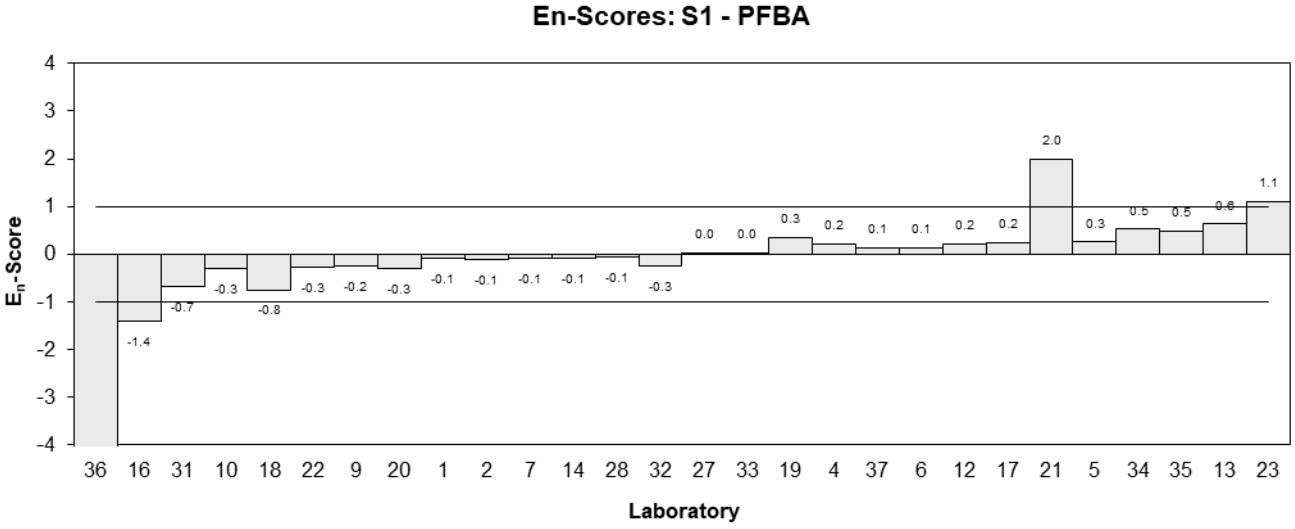

En-Scores: S1 - PFBA
En-Score
Laboratory
36 16 31 10 18 22 9 20 1 2 7 14 28 32 27 33 19 4 37 6 12 17 21 5 34 35 13 23

Figure 2

Table 6

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFPeA |
| **Unit** | µg/kg |

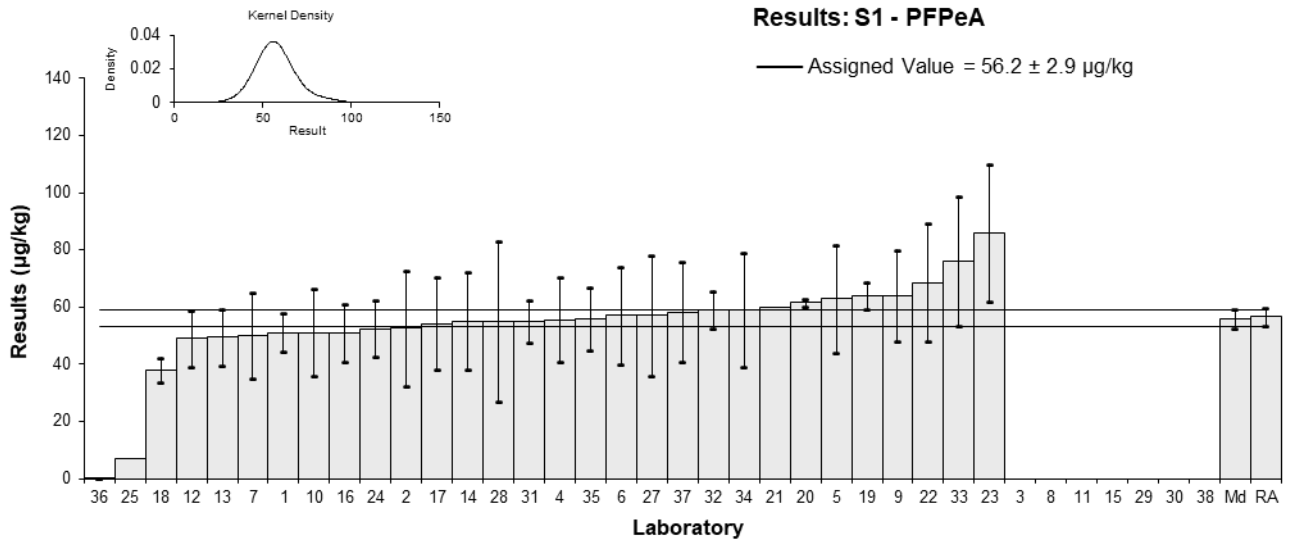
**Participant Results**

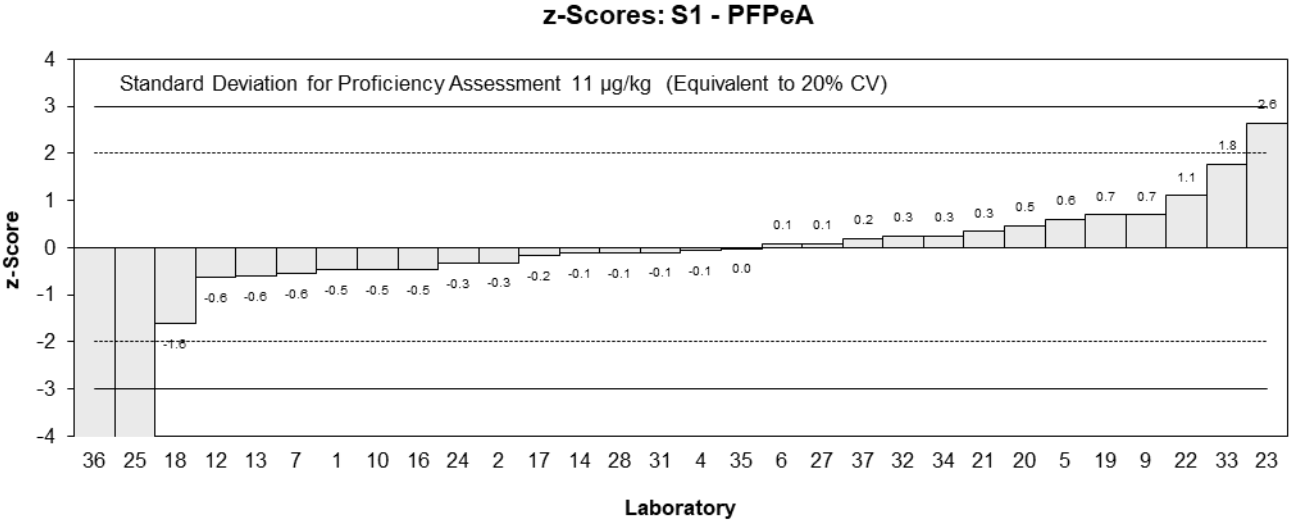
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 51 | 6.8 | 102 | -0.46 | -0.70 |
| **2** | 52.6 | 20.21 | NR | -0.32 | -0.18 |
| **3** | NT | NT | NT | | |
| **4** | 55.539 | 14.8 | 92 | -0.06 | -0.04 |
| **5** | 62.88725 | 18.86617 | 93 | 0.59 | 0.35 |
| **6** | 57 | 17.1 | 99 | 0.07 | 0.05 |
| **7** | 50 | 15 | NR | -0.55 | -0.41 |
| **8** | NS | NS | NS | | |
| **9** | 64 | 16 | 99 | 0.69 | 0.48 |
| **10** | 51 | 15.3 | 105 | -0.46 | -0.33 |
| **11** | NS | NS | NS | | |
| **12** | 49 | 9.8 | 147 | -0.64 | -0.70 |
| **13** | 49.46 | 9.9 | 62 | -0.60 | -0.65 |
| **14** | 55 | 17 | 104 | -0.11 | -0.07 |
| **15** | NS | NS | NS | | |
| **16** | 51 | 10 | NR | -0.46 | -0.50 |
| **17** | 54.20963 | 16.26289 | 90 | -0.18 | -0.12 |
| **18** | 38 | 4.2 | 97 | -1.62 | -3.57 |
| **19** | 63.9 | 4.78 | 71 | 0.69 | 1.38 |
| **20** | 61.5 | 1.19 | 113 | 0.47 | 1.69 |
| **21** | 60 | NR | 101 | 0.34 | 1.31 |
| **22** | 68.6 | 20.6 | 99 | 1.10 | 0.60 |
| **23*** | 85.9 | 24.1 | 97 | 2.64 | 1.22 |
| **24** | 52.4 | 9.9 | 77.31 | -0.34 | -0.37 |
| **25**** | 6.9 | NR | NR | -4.39 | -17.00 |
| **27** | 57 | 21 | NT | 0.07 | 0.04 |
| **28** | 55 | 28 | 89 | -0.11 | -0.04 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 55.1 | 7.34 | 105.42 | -0.10 | -0.14 |
| **32** | 59 | 6.5 | NR | 0.25 | 0.39 |
| **33** | 76.07 | 22.8 | 79 | 1.77 | 0.86 |
| **34** | 59 | 20 | 94 | 0.25 | 0.14 |
| **35** | 56 | 11 | 101.6 | -0.02 | -0.02 |
| **36**** | 0.0558 | 0.0047 | 103 | -5.00 | -19.36 |
| **37** | 58.29 | 17.49 | 94 | 0.19 | 0.12 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 56.2 | 2.9 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 56.6 | 3.0 |
| **Median** | 55.8 | 3.2 |
| **Mean** | 57.4 | |
| **N** | 28 | |
| **Max** | 85.9 | |
| **Min** | 38 | |
| **Robust SD** | 6.4 | |
| **Robust CV** | 11% | |


Kernel Density
Density
Result
Results: S1 - PFPeA
Assigned Value = 56.2 ± 2.9 µg/kg
Results (µg/kg)
Laboratory
36 25 18 12 13 7 1 10 16 24 2 17 14 28 31 4 35 6 27 37 32 34 21 20 5 19 9 22 33 23 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFPeA
Standard Deviation for Proficiency Assessment 11 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 18 12 13 7 1 10 16 24 2 17 14 28 31 4 35 6 27 37 32 34 21 20 5 19 9 22 33 23

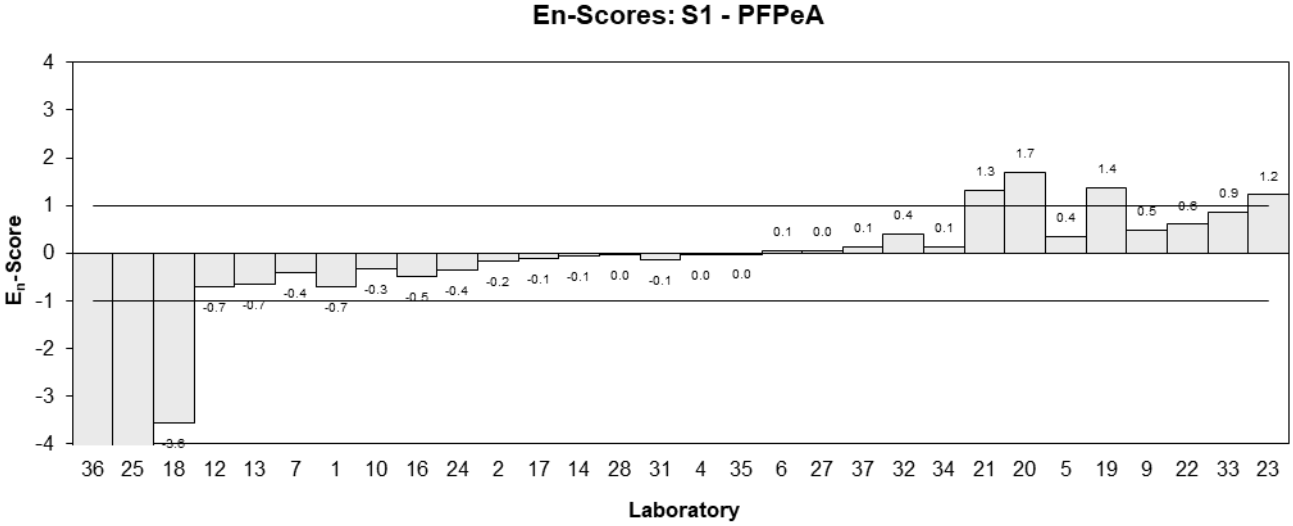

En-Scores: S1 - PFPeA
En-Score
Laboratory
36 25 18 12 13 7 1 10 16 24 2 17 14 28 31 4 35 6 27 37 32 34 21 20 5 19 9 22 33 23

Figure 3

Table 7

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFHxA |
| **Unit** | µg/kg |

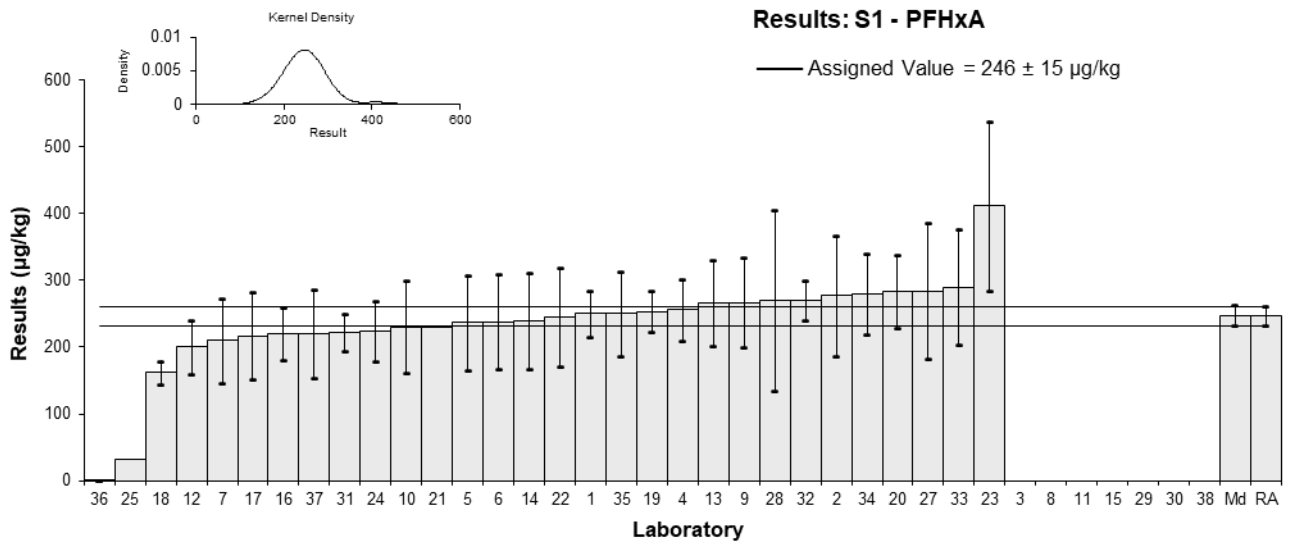
**Participant Results**

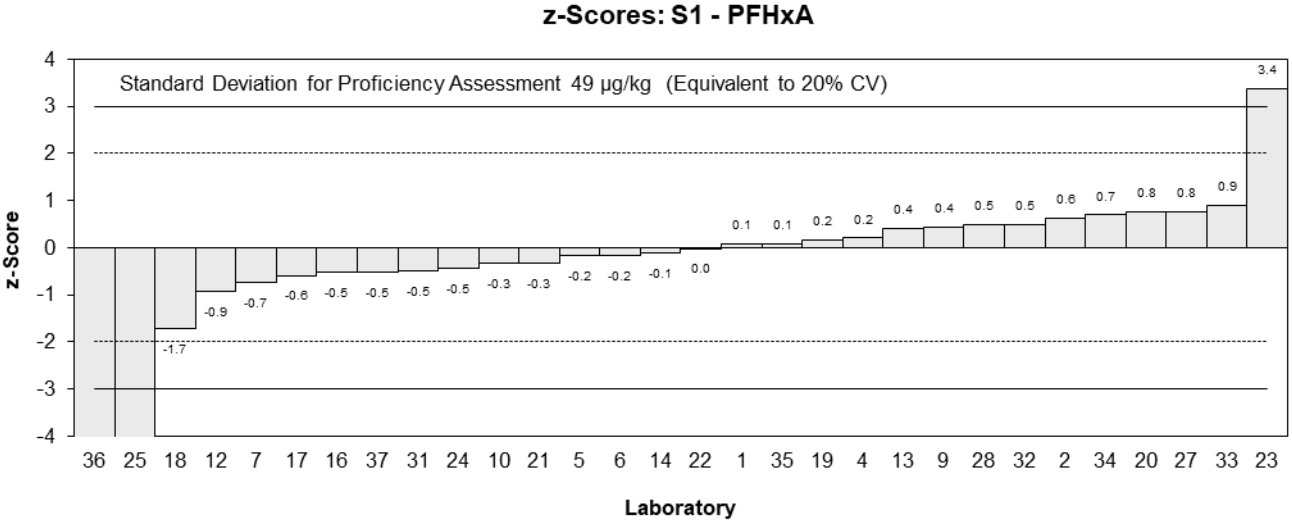
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 250 | 34 | 93 | 0.08 | 0.11 |
| **2** | 277 | 90.88 | NR | 0.63 | 0.34 |
| **3** | NT | NT | NT | | |
| **4** | 255.716 | 45.31 | 94 | 0.20 | 0.20 |
| **5** | 237.3048 | 71.19146 | 133 | -0.18 | -0.12 |
| **6** | 238 | 71.4 | 118 | -0.16 | -0.11 |
| **7** | 210 | 63 | NR | -0.73 | -0.56 |
| **8** | NS | NS | NS | | |
| **9** | 267 | 67 | 105 | 0.43 | 0.31 |
| **10** | 230 | 69 | 97.5 | -0.33 | -0.23 |
| **11** | NS | NS | NS | | |
| **12** | 200 | 40 | 78 | -0.93 | -1.08 |
| **13** | 266 | 64 | 79 | 0.41 | 0.30 |
| **14** | 240 | 72 | 69 | -0.12 | -0.08 |
| **15** | NS | NS | NS | | |
| **16** | 220 | 40 | NR | -0.53 | -0.61 |
| **17** | 217.0179 | 65.10538 | 111 | -0.59 | -0.43 |
| **18** | 161.7 | 17.8 | 112 | -1.71 | -3.62 |
| **19** | 253.7 | 30.7 | 75 | 0.16 | 0.23 |
| **20** | 283 | 54.5 | 102 | 0.75 | 0.65 |
| **21** | 230 | NR | 86 | -0.33 | -1.07 |
| **22** | 245 | 73.5 | 118 | -0.02 | -0.01 |
| **23*** | 412 | 127 | 88 | 3.37 | 1.30 |
| **24** | 224 | 45 | 84.2 | -0.45 | -0.46 |
| **25**** | 32 | NR | NR | -4.35 | -14.27 |
| **27** | 284 | 102 | NT | 0.77 | 0.37 |
| **28** | 270 | 135 | 89 | 0.49 | 0.18 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 222 | 28.28 | 109.3 | -0.49 | -0.75 |
| **32** | 270 | 30 | NR | 0.49 | 0.72 |
| **33** | 290.00 | 87.0 | 73 | 0.89 | 0.50 |
| **34** | 280 | 60 | 94 | 0.69 | 0.55 |
| **35** | 250 | 63 | 87.8 | 0.08 | 0.06 |
| **36**** | 0.233 | 0.033 | 97 | -5.00 | -16.38 |
| **37** | 220.31 | 66.09 | 105 | -0.52 | -0.38 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 246 | 15 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 247 | 15 |
| **Median** | 248 | 16 |
| **Mean** | 250 | |
| **N** | 28 | |
| **Max** | 412 | |
| **Min** | 161.7 | |
| **Robust SD** | 31 | |
| **Robust CV** | 13% | |


Kernel Density
Density
0.01
0.005
0
0
200
400
600
Result
Results: S1 - PFHxA
Assigned Value = 246 ± 15 µg/kg
Results (µg/kg)
600
500
400
300
200
100
0
36 25 18 12 7 17 16 37 31 24 10 21 5 6 14 22 1 35 19 4 13 9 28 32 2 34 20 27 33 23 3 8 11 15 29 30 38 Md RA
Laboratory


z-Scores: S1 - PFHxA
Standard Deviation for Proficiency Assessment 49 µg/kg (Equivalent to 20% CV)
z-Score
4
3
2
1
0
-1
-2
-3
-4
3.4
0.9
0.8 0.8
0.7
0.6
0.5 0.5
0.4 0.4
0.2 0.2
0.1 0.1
0.0
-0.1
-0.2 -0.2
-0.3 -0.3
-0.5 -0.5 -0.5 -0.5 -0.5
-0.6
-0.7
-0.9
-1.7
36 25 18 12 7 17 16 37 31 24 10 21 5 6 14 22 1 35 19 4 13 9 28 32 2 34 20 27 33 23
Laboratory

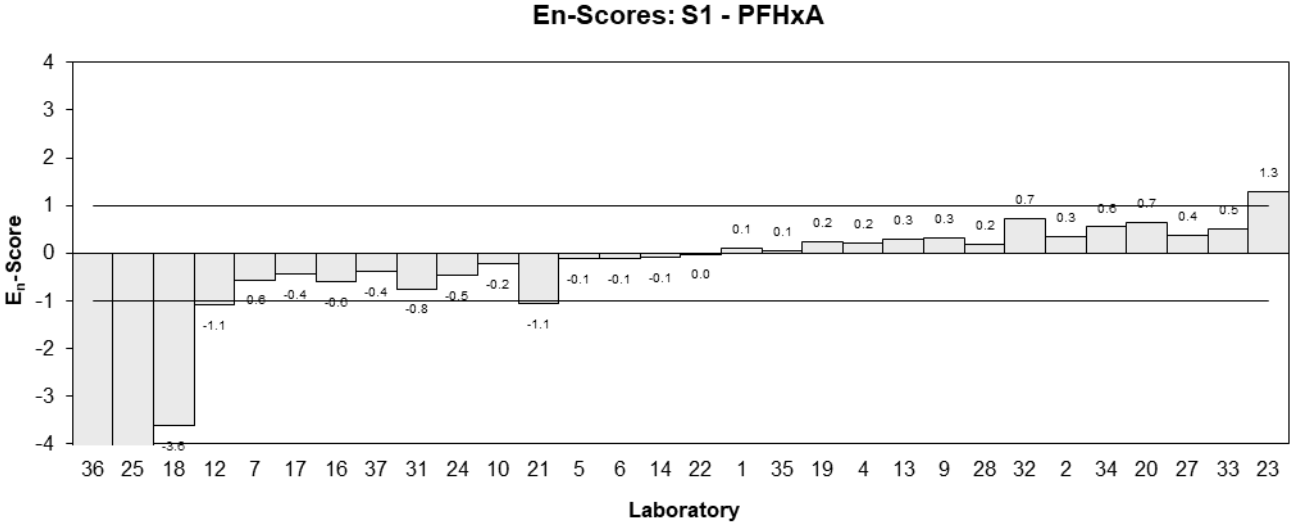

En-Scores: S1 - PFHxA
En-Score
4
3
2
1
0
-1
-2
-3
-4
1.3
0.7
0.7
0.6
0.6
0.5
0.4
0.3
0.3
0.2 0.2
0.1 0.1
0.0
-0.1 -0.1 -0.1
-0.2
-0.4
-0.4
-0.4
-0.5
-0.6
-0.8
-1.1
-1.1
-3.6
36 25 18 12 7 17 16 37 31 24 10 21 5 6 14 22 1 35 19 4 13 9 28 32 2 34 20 27 33 23
Laboratory

Figure 4

Table 8

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFHpA |
| **Unit** | µg/kg |

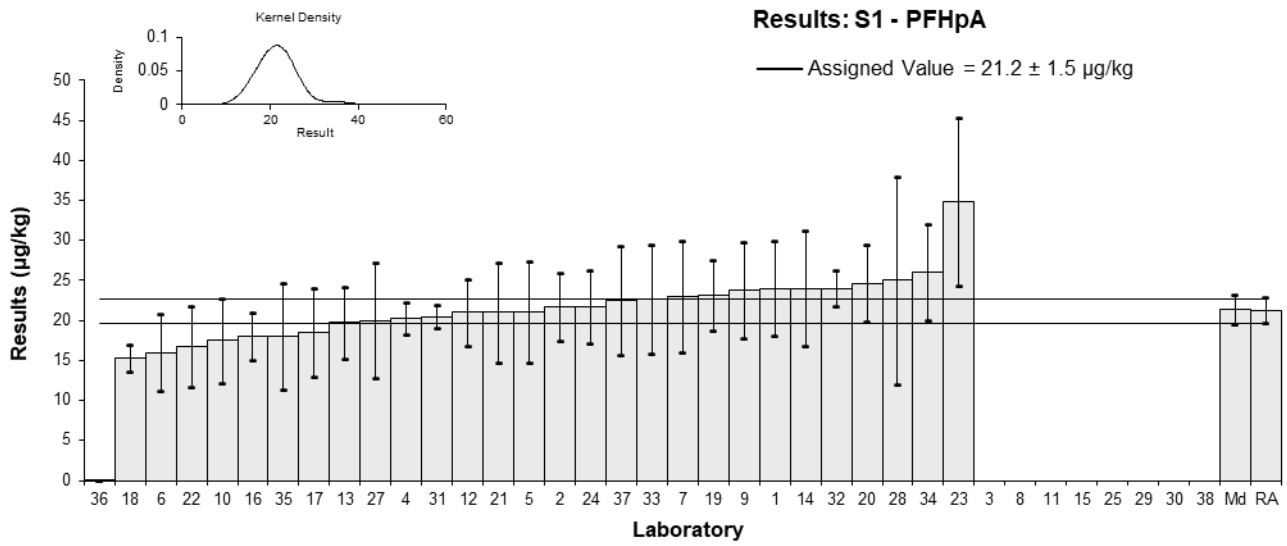
**Participant Results**

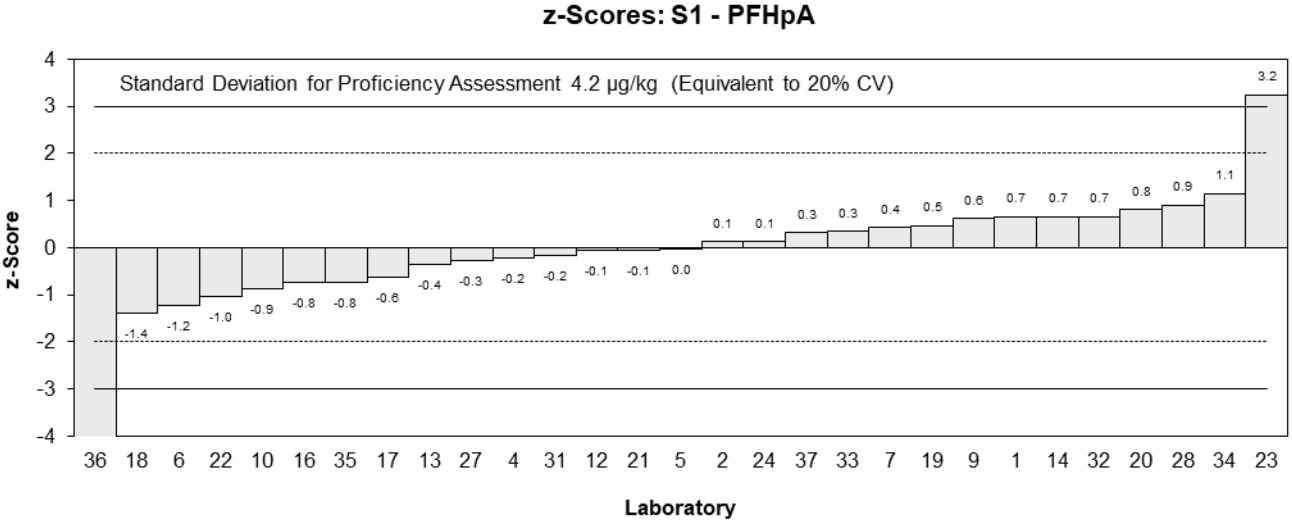
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 24 | 5.9 | 98 | 0.66 | 0.46 |
| **2** | 21.7 | 4.25 | NR | 0.12 | 0.11 |
| **3** | NT | NT | NT | | |
| **4** | 20.257 | 1.94 | 94 | -0.22 | -0.38 |
| **5** | 21.05883 | 6.317649 | 73 | -0.03 | -0.02 |
| **6** | 16 | 4.8 | 99 | -1.23 | -1.03 |
| **7** | 23 | 6.9 | NR | 0.42 | 0.25 |
| **8** | NS | NS | NS | | |
| **9** | 23.8 | 6.0 | 103 | 0.61 | 0.42 |
| **10** | 17.5 | 5.25 | 110 | -0.87 | -0.68 |
| **11** | NS | NS | NS | | |
| **12** | 21 | 4.2 | 104 | -0.05 | -0.04 |
| **13** | 19.71 | 4.5 | 77 | -0.35 | -0.31 |
| **14** | 24 | 7.2 | 69 | 0.66 | 0.38 |
| **15** | NS | NS | NS | | |
| **16** | 18 | 3 | NR | -0.75 | -0.95 |
| **17** | 18.51755 | 5.555267 | 34 | -0.63 | -0.47 |
| **18** | 15.3 | 1.7 | 113 | -1.39 | -2.60 |
| **19** | 23.1 | 4.4 | 80 | 0.45 | 0.41 |
| **20** | 24.6 | 4.8 | 104 | 0.80 | 0.68 |
| **21** | 21 | 6.3 | 95 | -0.05 | -0.03 |
| **22** | 16.8 | 5.04 | 99 | -1.04 | -0.84 |
| **23*** | 34.9 | 10.5 | 78 | 3.23 | 1.29 |
| **24** | 21.7 | 4.6 | 79.67 | 0.12 | 0.10 |
| **25** | <5 | NR | NR | | |
| **27** | 20 | 7.2 | NT | -0.28 | -0.16 |
| **28** | 25 | 13 | 82 | 0.90 | 0.29 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 20.5 | 1.45 | 108.45 | -0.17 | -0.34 |
| **32** | 24 | 2.2 | NR | 0.66 | 1.05 |
| **33** | 22.65 | 6.79 | 83 | 0.34 | 0.21 |
| **34** | 26 | 6 | 83 | 1.13 | 0.78 |
| **35** | 18 | 6.7 | 92.3 | -0.75 | -0.47 |
| **36**** | 0.0186 | 0.0015 | 89 | -5.00 | -14.12 |
| **37** | 22.5 | 6.75 | 112 | 0.31 | 0.19 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 21.2 | 1.5 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 21.3 | 1.6 |
| **Median** | 21.4 | 1.8 |
| **Mean** | 21.6 | |
| **N** | 28 | |
| **Max** | 34.9 | |
| **Min** | 15.3 | |
| **Robust SD** | 3.3 | |
| **Robust CV** | 15% | |


Kernel Density
Density
Result
Results: S1 - PFHpA
Assigned Value = 21.2 ± 1.5 µg/kg
Results (µg/kg)
Laboratory
36 18 6 22 10 16 35 17 13 27 4 31 12 21 5 2 24 37 33 7 19 9 1 14 32 20 28 34 23 3 8 11 15 25 29 30 38 Md RA


z-Scores: S1 - PFHpA
Standard Deviation for Proficiency Assessment 4.2 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 18 6 22 10 16 35 17 13 27 4 31 12 21 5 2 24 37 33 7 19 9 1 14 32 20 28 34 23

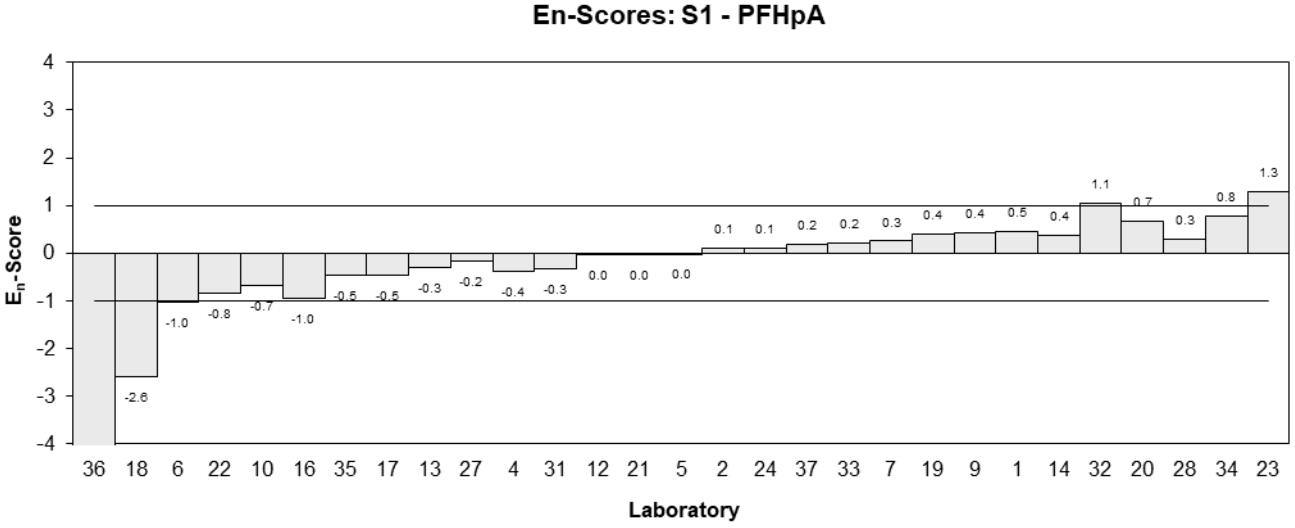

En-Scores: S1 - PFHpA
En-Score
Laboratory
36 18 6 22 10 16 35 17 13 27 4 31 12 21 5 2 24 37 33 7 19 9 1 14 32 20 28 34 23

Figure 5

Table 9

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFOA |
| **Unit** | µg/kg |

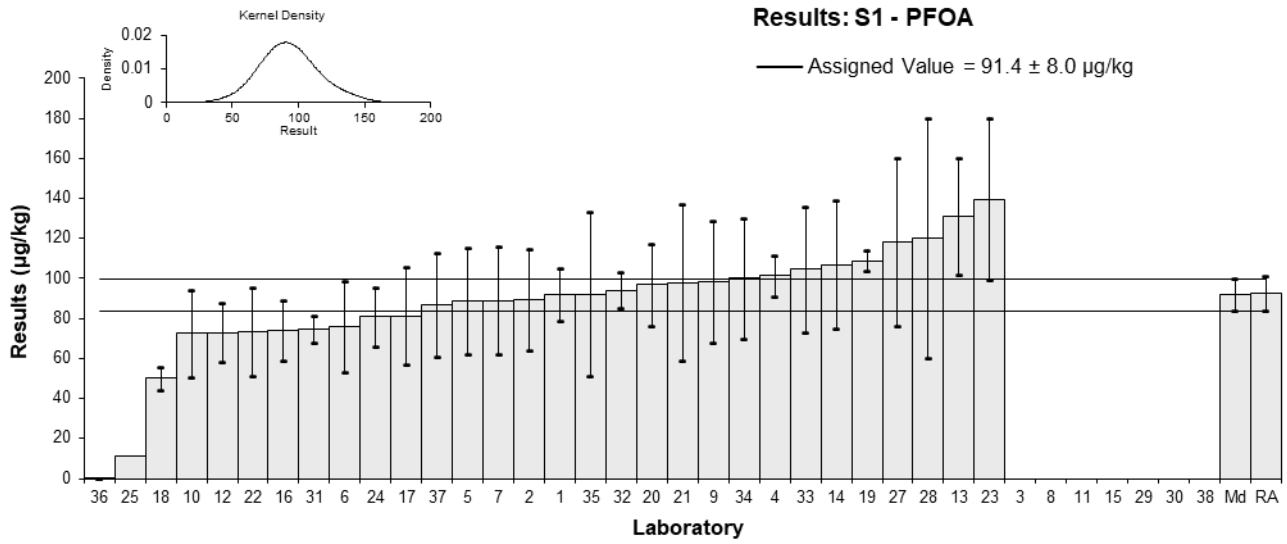
**Participant Results**

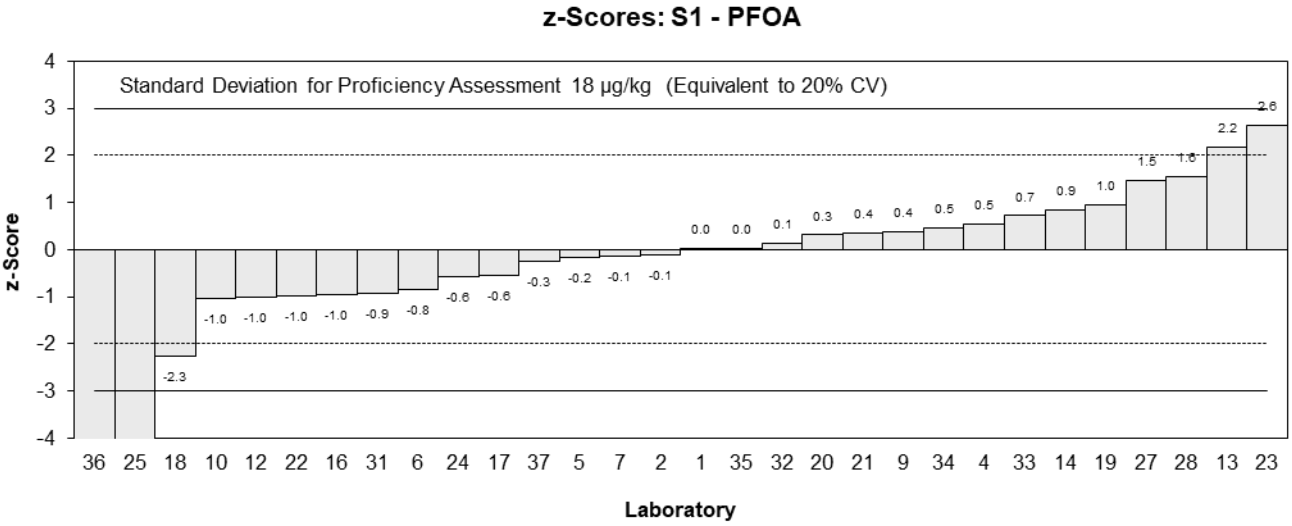
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 92 | 13 | 96 | 0.03 | 0.04 |
| **2** | 89.4 | 25.59 | NR | -0.11 | -0.07 |
| **3** | NT | NT | NT | | |
| **4** | 101.335 | 10.07 | 92 | 0.54 | 0.77 |
| **5** | 88.56493 | 26.56947 | 101 | -0.16 | -0.10 |
| **6** | 76 | 22.8 | 101 | -0.84 | -0.64 |
| **7** | 89 | 27 | NR | -0.13 | -0.09 |
| **8** | NS | NS | NS | | |
| **9** | 98.3 | 30.5 | 98 | 0.38 | 0.22 |
| **10** | 72.5 | 21.75 | 110 | -1.03 | -0.82 |
| **11** | NS | NS | NS | | |
| **12** | 73 | 14.6 | 101 | -1.01 | -1.11 |
| **13** | 131 | 29 | 88 | 2.17 | 1.32 |
| **14** | 107 | 32 | 66 | 0.85 | 0.47 |
| **15** | NS | NS | NS | | |
| **16** | 74 | 15 | NR | -0.95 | -1.02 |
| **17** | 81.24415 | 24.37324 | 101 | -0.56 | -0.40 |
| **18** | 50 | 5.5 | 73 | -2.26 | -4.26 |
| **19** | 108.9 | 5.33 | 78 | 0.96 | 1.82 |
| **20** | 97 | 20.5 | 126 | 0.31 | 0.25 |
| **21** | 98 | 39 | 119 | 0.36 | 0.17 |
| **22** | 73.3 | 22 | 101 | -0.99 | -0.77 |
| **23*** | 139.6 | 40.5 | 93 | 2.64 | 1.17 |
| **24** | 81.0 | 14.8 | 81.08 | -0.57 | -0.62 |
| **25**** | 11 | NR | NR | -4.40 | -10.05 |
| **27** | 118 | 42 | NT | 1.46 | 0.62 |
| **28** | 120 | 60 | 108 | 1.56 | 0.47 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 74.5 | 6.78 | 112.58 | -0.92 | -1.61 |
| **32** | 94 | 8.9 | NR | 0.14 | 0.22 |
| **33** | 104.52 | 31.40 | 57 | 0.72 | 0.40 |
| **34** | 100 | 30 | 96 | 0.47 | 0.28 |
| **35** | 92 | 41 | 99.0 | 0.03 | 0.01 |
| **36**** | 0.083 | 0.011 | 90 | -5.00 | -11.41 |
| **37** | 86.89 | 26.07 | 99 | -0.25 | -0.17 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 91.4 | 8.0 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 92.7 | 8.5 |
| **Median** | 92.0 | 8.2 |
| **Mean** | 93.3 | |
| **N** | 28 | |
| **Max** | 139.6 | |
| **Min** | 50 | |
| **Robust SD** | 18 | |
| **Robust CV** | 19% | |


Kernel Density
Density
Result
Results: S1 - PFOA
Assigned Value = 91.4 ± 8.0 µg/kg
Results (µg/kg)
Laboratory
36 25 18 10 12 22 16 31 6 24 17 37 5 7 2 1 35 32 20 21 9 34 4 33 14 19 27 28 13 23 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFOA
Standard Deviation for Proficiency Assessment 18 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 18 10 12 22 16 31 6 24 17 37 5 7 2 1 35 32 20 21 9 34 4 33 14 19 27 28 13 23

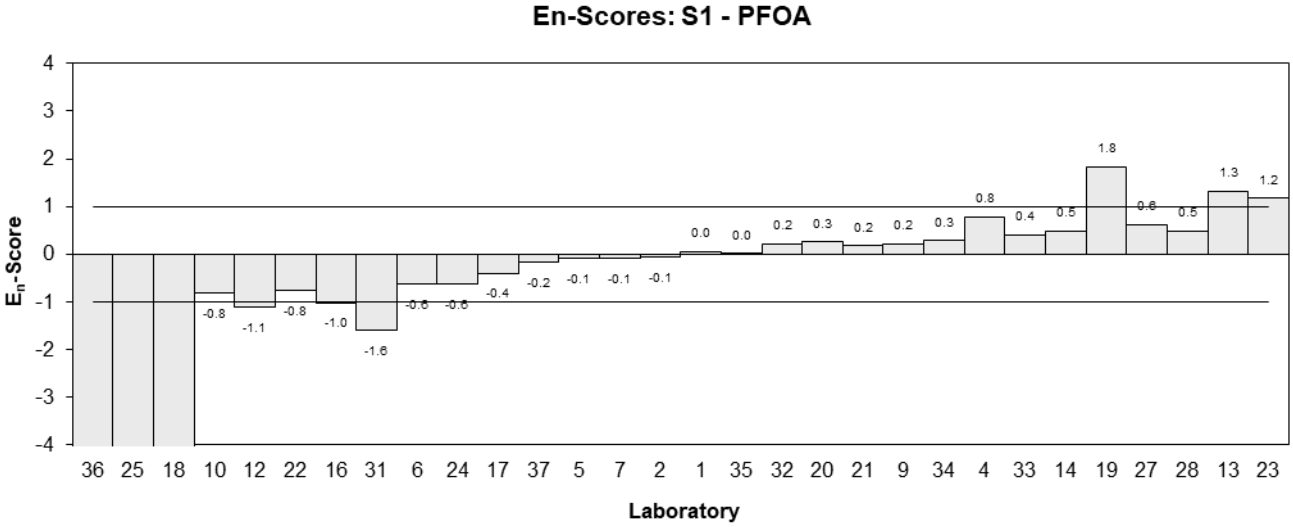

En-Scores: S1 - PFOA
En-Score
Laboratory
36 25 18 10 12 22 16 31 6 24 17 37 5 7 2 1 35 32 20 21 9 34 4 33 14 19 27 28 13 23

Figure 6

Table 10

**Sample Details**

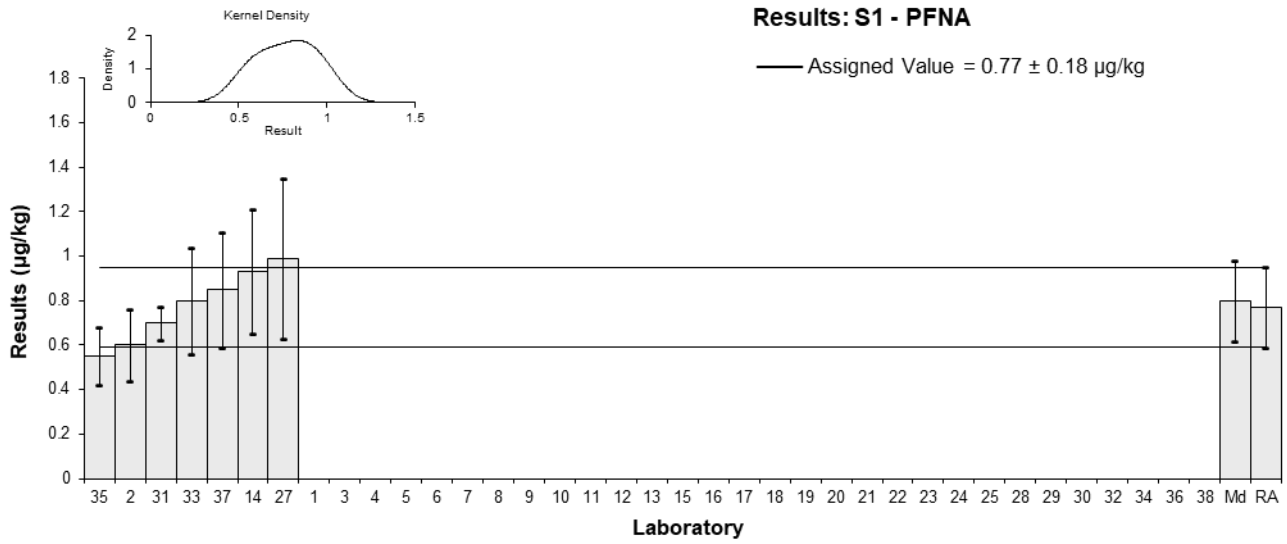
| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFNA |
| **Unit** | µg/kg |

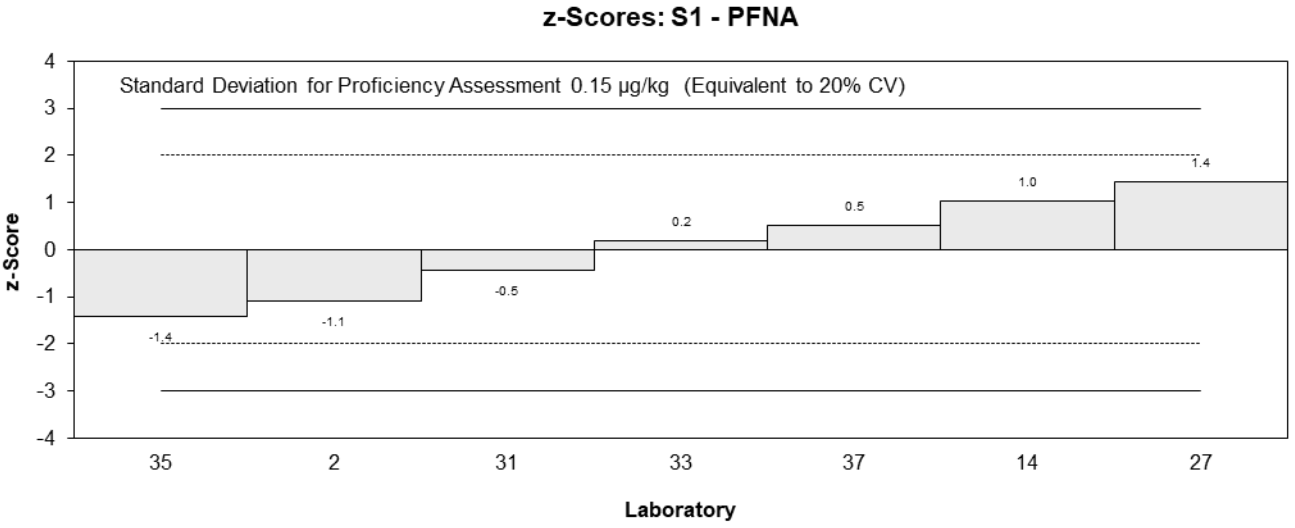
**Participant Results**

| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <5.0 | NR | 40 | | |
| **2** | 0.6 | 0.16 | NR | -1.10 | -0.71 |
| **3** | NT | NT | NT | | |
| **4** | <0.3 | 0.3 | 94 | | |
| **5** | <1 | NR | 33 | | |
| **6** | <0.001 | NR | NR | | |
| **7** | <5 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | <2 | NR | NR | | |
| **10** | <1 | NR | 110 | | |
| **11** | NS | NS | NS | | |
| **12** | NR | NR | NR | | |
| **13** | <1 | NR | NR | | |
| **14** | 0.93 | 0.28 | 76 | 1.04 | 0.48 |
| **15** | NS | NS | NS | | |
| **16** | <0.5 | NR | NR | | |
| **17** | <1 | NR | 12 | | |
| **18** | <5 | NR | NR | | |
| **19** | <0.5 | NR | 17 | | |
| **20** | <0.5 | NR | 103 | | |
| **21** | <0.5 | NR | 87 | | |
| **22** | <0.001 | NR | NR | | |
| **23** | <1 | NR | 98 | | |
| **24** | <9.9 | NR | 89.13 | | |
| **25** | <5 | NR | NR | | |
| **27** | 0.99 | 0.36 | NT | 1.43 | 0.55 |
| **28** | < 10 | 5 | 95 | | |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 0.7 | 0.075 | 103.22 | -0.45 | -0.36 |
| **32** | <10 | NR | NR | | |
| **33** | 0.80 | 0.24 | 86 | 0.19 | 0.10 |
| **34** | <1 | NR | 81 | | |
| **35** | 0.55 | 0.13 | 87.1 | -1.43 | -0.99 |
| **36** | < 0.0010 | 0.00011 | 76 | | |
| **37** | 0.85 | 0.26 | 102 | 0.52 | 0.25 |
| **38** | NS | NS | NS | | |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 0.77 | 0.18 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 0.77 | 0.18 |
| **Median** | 0.80 | 0.18 |
| **Mean** | 0.77 | |
| **N** | 7 | |
| **Max** | 0.99 | |
| **Min** | 0.55 | |
| **Robust SD** | 0.19 | |
| **Robust CV** | 24% | |


Kernel Density
Density
Result
Results: S1 - PFNA
Assigned Value = 0.77 ± 0.18 µg/kg
Results (µg/kg)
35 2 31 33 37 14 27 1 3 4 5 6 7 8 9 10 11 12 13 15 16 17 18 19 20 21 22 23 24 25 28 29 30 32 34 36 38 Md RA
Laboratory


z-Scores: S1 - PFNA
Standard Deviation for Proficiency Assessment 0.15 µg/kg (Equivalent to 20% CV)
z-Score
-1.4
-1.1
-0.5
0.2
0.5
1.0
1.4
35 2 31 33 37 14 27
Laboratory

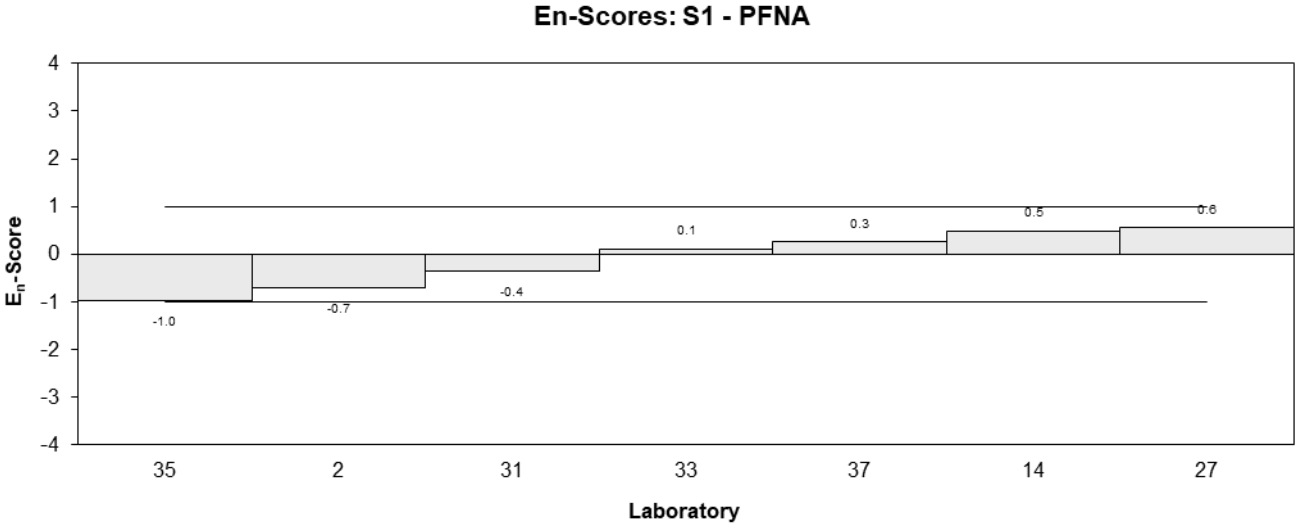

En-Scores: S1 - PFNA
En-Score
-1.0
-0.7
-0.4
0.1
0.3
0.5
0.6
35 2 31 33 37 14 27
Laboratory

Figure 7

Table 11

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFDA |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | <1.0 | NR | 102 |
| **2** | 0.4 | 0.12 | NR |
| **3** | NT | NT | NT |
| **4** | <0.2 | 0.2 | 94 |
| **5** | 0.22867 | 0.068601 | 112 |
| **6** | <0.001 | NR | NR |
| **7** | <5 | NR | NR |
| **8** | NS | NS | NS |
| **9** | <2 | NR | NR |
| **10** | <1 | NR | 72.5 |
| **11** | NS | NS | NS |
| **12** | NR | NR | NR |
| **13** | <1 | NR | NR |
| **14** | < 0.1 | NR | 53 |
| **15** | NS | NS | NS |
| **16** | <1 | NR | NR |
| **17** | 0.223703 | 0.067110 | 109 |
| **18** | <5 | NR | NR |
| **19** | <0.5 | NR | 102 |
| **20** | <0.5 | NR | 123 |
| **21** | <0.5 | NR | 81 |
| **22** | <0.001 | NR | NR |
| **23** | <1 | NR | 95 |
| **24** | <9.9 | NR | 86.66 |
| **25** | <5 | NR | NR |
| **27** | <0.24 | 0.086 | NT |
| **28** | < 1 | 0.5 | 135 |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 0.2 | 0.026 | 106.78 |
| **32** | <10 | NR | NR |
| **33** | < 0.5 | NR | 55 |
| **34** | <5 | NR | 93 |
| **35** | 0.21 | 0.040 | 102.8 |
| **36** | < 0.0010 | 0.00014 | 99 |
| **37**** | 8.55 | 2.57 | 112 |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | NA (N<6) | |
| **Median** | 0.224 | 0.023 |
| **Mean** | 0.252 | |
| **N** | 5 | |
| **Max** | 0.4 | |
| **Min** | 0.2 | |
| **Robust SD** | NA (N<6) | |
| **Robust CV** | NA (N<6) | |

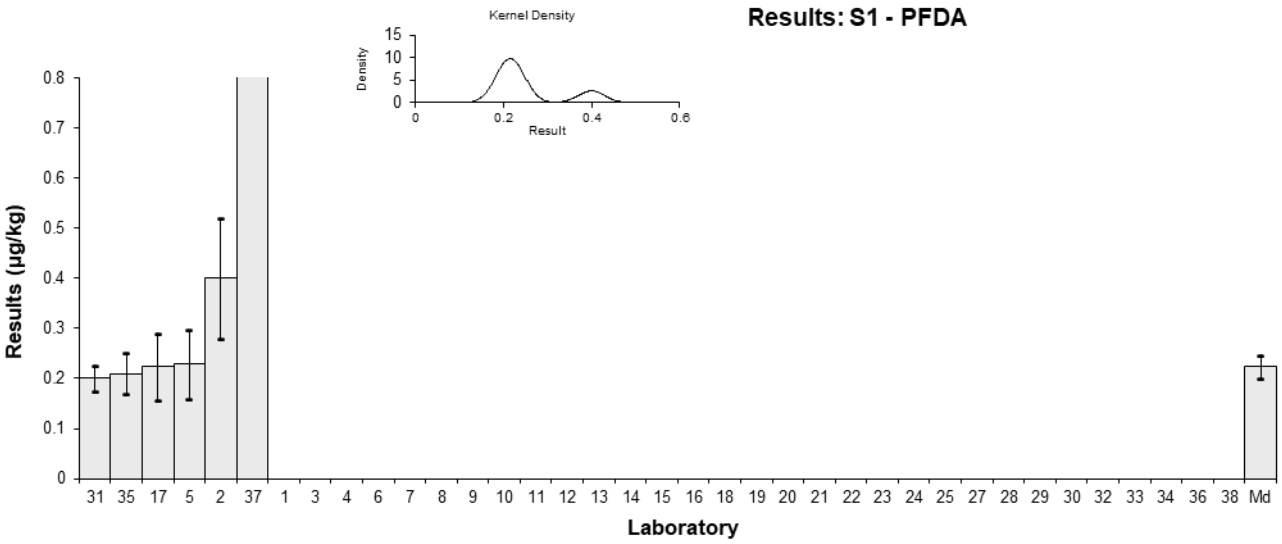

Results: S1 - PFDA
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
31 35 17 5 2 37 1 3 4 6 7 8 9 10 11 12 13 14 15 16 18 19 20 21 22 23 24 25 27 28 29 30 32 33 34 36 38 Md

Figure 8

Table 12

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFDoA |
| **Unit** | µg/kg |

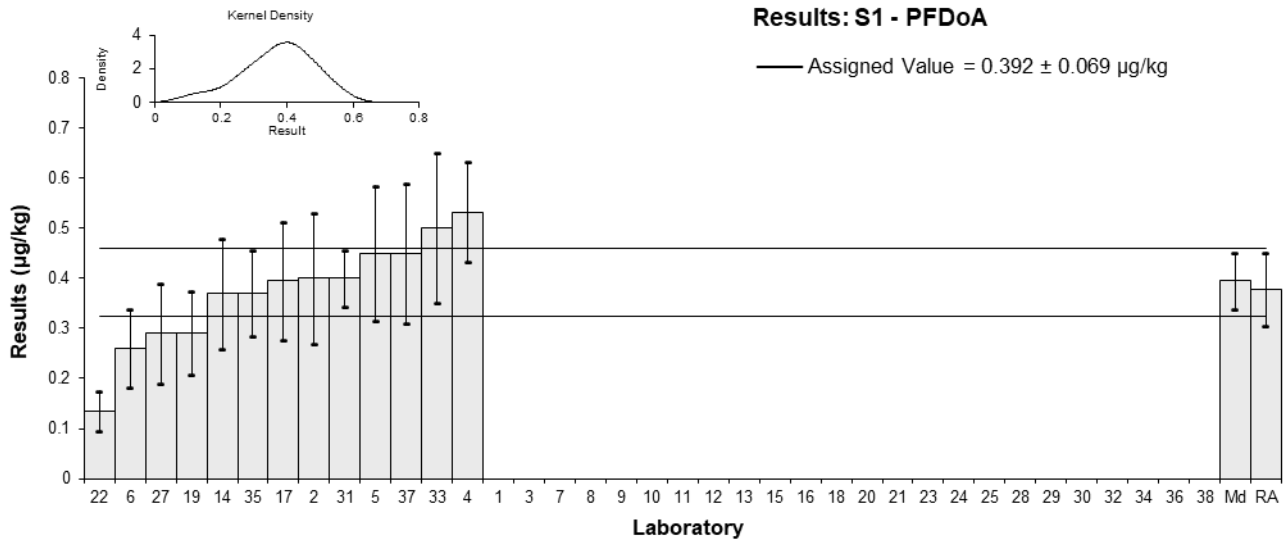
**Participant Results**

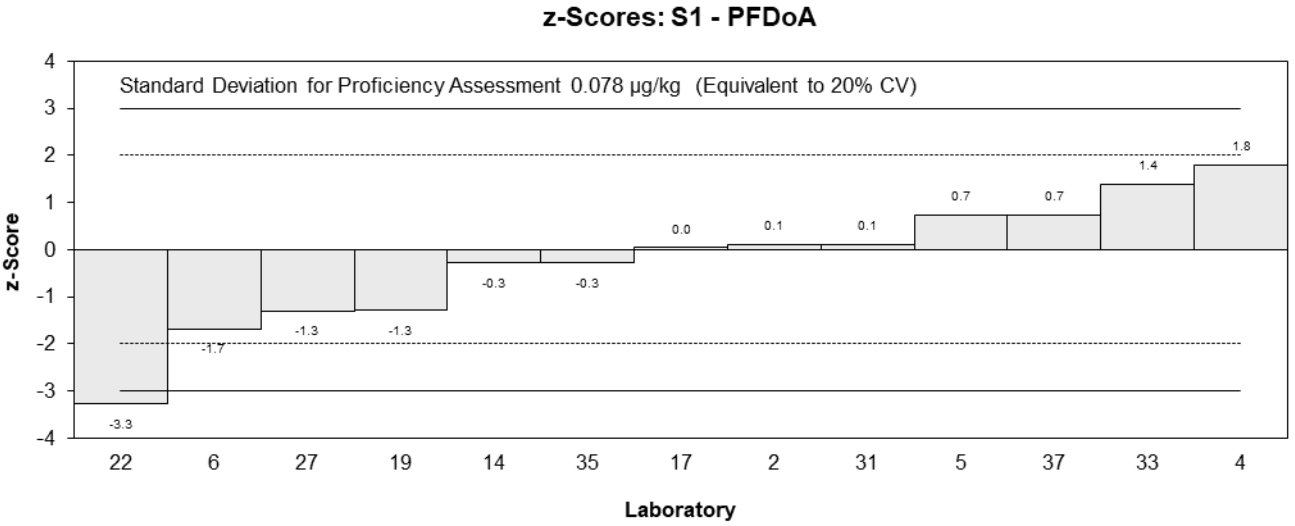
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <1.0 | NR | 112 | | |
| **2** | 0.4 | 0.13 | NR | 0.10 | 0.05 |
| **3** | NT | NT | NT | | |
| **4** | 0.533 | 0.1 | 99 | 1.80 | 1.16 |
| **5** | 0.44974 | 0.134922 | 53 | 0.74 | 0.38 |
| **6** | 0.26 | 0.078 | 88 | -1.68 | -1.27 |
| **7** | <5 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | <2 | NR | NR | | |
| **10** | <1 | NR | 110 | | |
| **11** | NS | NS | NS | | |
| **12** | NR | NR | NR | | |
| **13** | <1 | NR | NR | | |
| **14** | 0.37 | 0.11 | 80 | -0.28 | -0.17 |
| **15** | NS | NS | NS | | |
| **16** | <1 | NR | NR | | |
| **17** | 0.395104 | 0.118531 | 106 | 0.04 | 0.02 |
| **18** | <5 | NR | NR | | |
| **19** | 0.291 | 0.084 | 62 | -1.29 | -0.93 |
| **20** | <0.5 | NR | 114 | | |
| **21** | <0.5 | NR | 122 | | |
| **22*** | 0.135 | 0.0406 | 88 | -3.28 | -3.21 |
| **23** | <1 | NR | 98 | | |
| **24** | <9.9 | NR | 86.19 | | |
| **25** | <5 | NR | NR | | |
| **27** | 0.29 | 0.10 | NT | -1.30 | -0.84 |
| **28** | < 2 | 1 | 94 | | |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 0.4 | 0.056 | 110.06 | 0.10 | 0.09 |
| **32** | <10 | NR | NR | | |
| **33** | 0.50 | 0.15 | 80 | 1.38 | 0.65 |
| **34** | <5 | NR | 95 | | |
| **35** | 0.37 | 0.085 | 95.1 | -0.28 | -0.20 |
| **36** | < 0.0010 | 0.00015 | 84 | | |
| **37** | 0.45 | 0.14 | 100 | 0.74 | 0.37 |
| **38** | NS | NS | NS | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 0.392 | 0.069 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 0.379 | 0.073 |
| **Median** | 0.395 | 0.056 |
| **Mean** | 0.373 | |
| **N** | 13 | |
| **Max** | 0.533 | |
| **Min** | 0.135 | |
| **Robust SD** | 0.11 | |
| **Robust CV** | 28% | |


Results: S1 - PFDoA
Assigned Value = 0.392 ± 0.069 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
22 6 27 19 14 35 17 2 31 5 37 33 4 1 3 7 8 9 10 11 12 13 15 16 18 20 21 23 24 25 28 29 30 32 34 36 38 Md RA


z-Scores: S1 - PFDoA
Standard Deviation for Proficiency Assessment 0.078 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
22 6 27 19 14 35 17 2 31 5 37 33 4
-3.3
-1.7
-1.3
-1.3
-0.3
-0.3
0.0
0.1
0.1
0.7
0.7
1.4
1.8

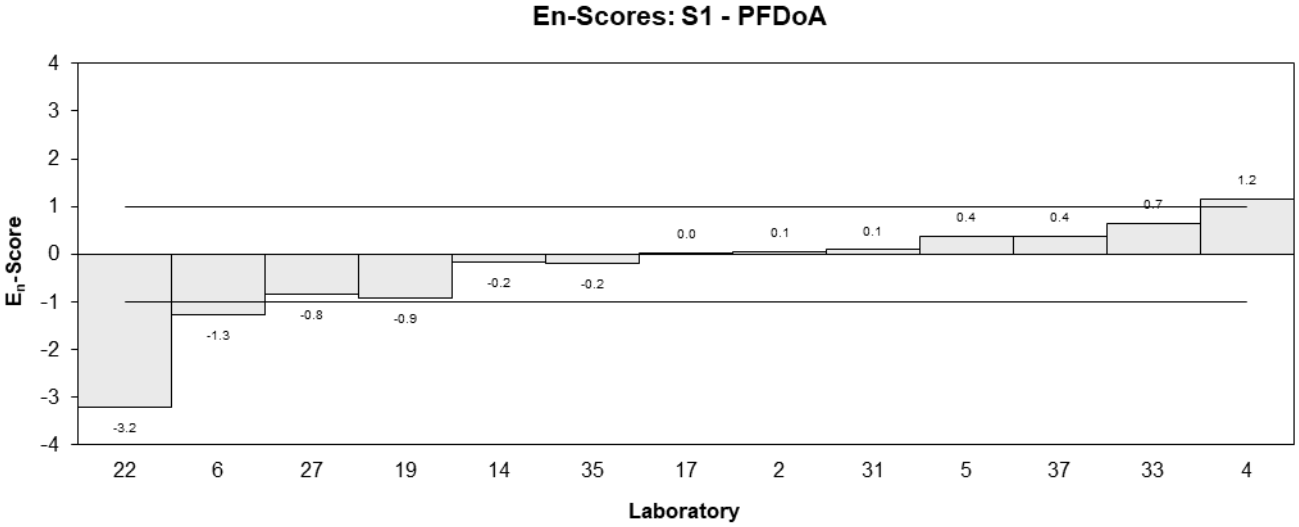

En-Scores: S1 - PFDoA
En-Score
Laboratory
22 6 27 19 14 35 17 2 31 5 37 33 4
-3.2
-1.3
-0.8
-0.9
-0.2
-0.2
0.0
0.1
0.1
0.4
0.4
0.7
1.2

Figure 9

Table 13

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFBS |
| **Unit** | µg/kg |

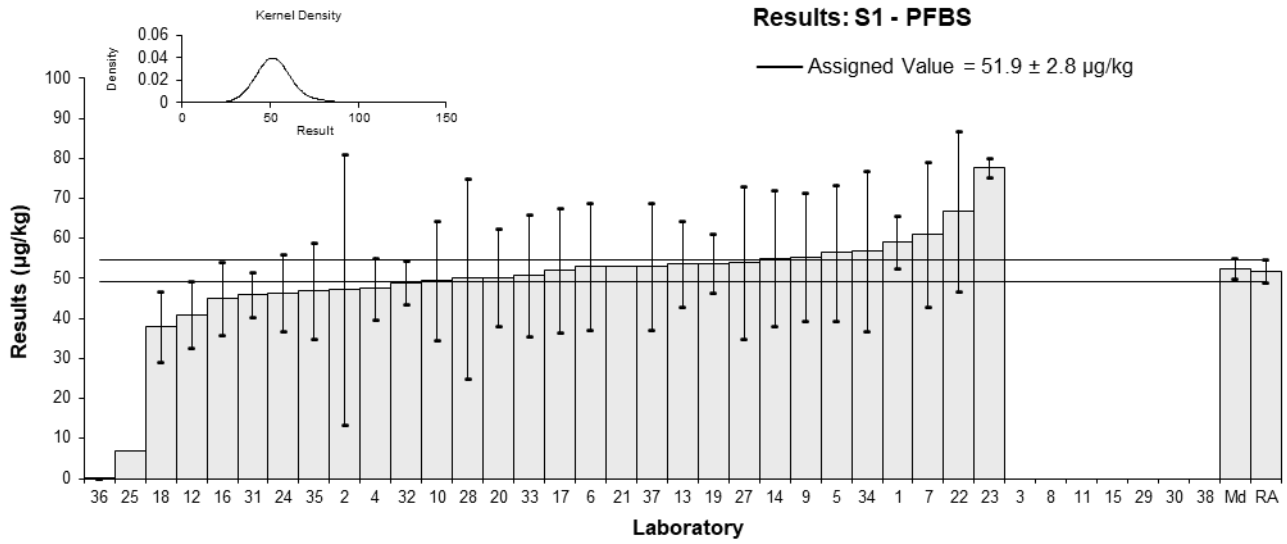
**Participant Results**

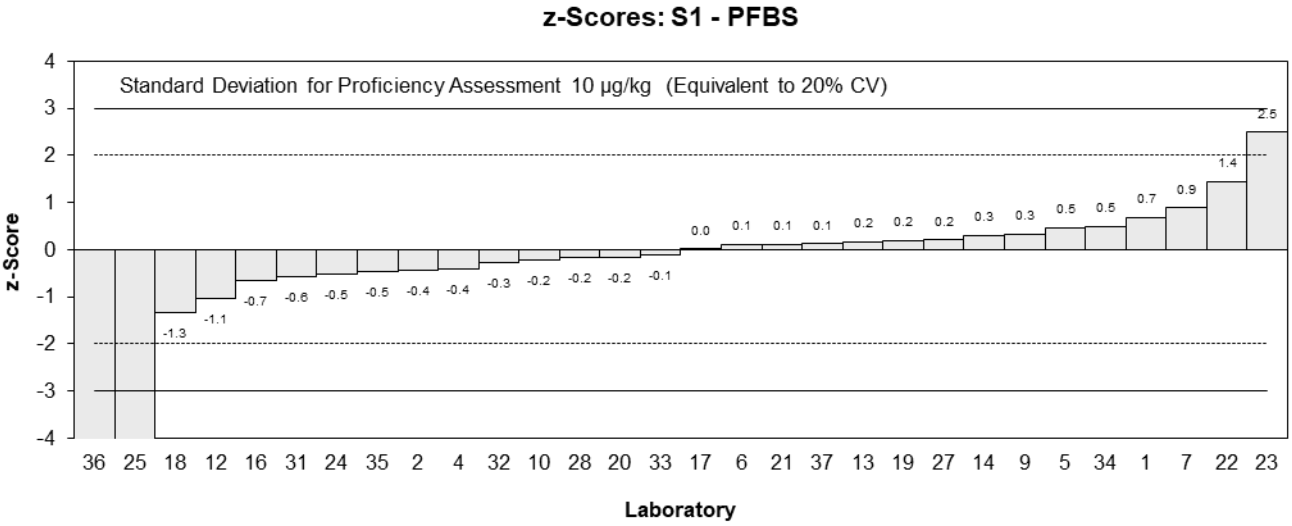
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 59 | 6.6 | 99 | 0.68 | 0.99 |
| **2** | 47.3 | 33.71 | NR | -0.44 | -0.14 |
| **3** | NT | NT | NT | | |
| **4** | 47.527 | 7.64 | 86 | -0.42 | -0.54 |
| **5** | 56.52074 | 16.95622 | 96 | 0.45 | 0.27 |
| **6** | 53 | 15.9 | 99 | 0.11 | 0.07 |
| **7** | 61 | 18 | NR | 0.88 | 0.50 |
| **8** | NS | NS | NS | | |
| **9** | 55.3 | 16.0 | 102 | 0.33 | 0.21 |
| **10** | 49.5 | 14.85 | 105 | -0.23 | -0.16 |
| **11** | NS | NS | NS | | |
| **12** | 41 | 8.2 | 102 | -1.05 | -1.26 |
| **13** | 53.61 | 10.7 | 80 | 0.16 | 0.15 |
| **14** | 55 | 17 | 68 | 0.30 | 0.18 |
| **15** | NS | NS | NS | | |
| **16** | 45 | 9 | NR | -0.66 | -0.73 |
| **17** | 51.98257 | 15.59477 | 97 | 0.01 | 0.01 |
| **18** | 38 | 8.7 | 83 | -1.34 | -1.52 |
| **19** | 53.8 | 7.3 | 150 | 0.18 | 0.24 |
| **20** | 50.2 | 12.2 | 124 | -0.16 | -0.14 |
| **21** | 53 | NR | 111 | 0.11 | 0.39 |
| **22** | 66.886 | 20.1 | 99 | 1.44 | 0.74 |
| **23** | 77.7 | 2.3 | 99 | 2.49 | 7.12 |
| **24** | 46.4 | 9.6 | 75.13 | -0.53 | -0.55 |
| **25**** | 6.9 | NR | NR | -4.34 | -16.07 |
| **27** | 54 | 19 | NT | 0.20 | 0.11 |
| **28** | 50 | 25 | 98 | -0.18 | -0.08 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 46 | 5.47 | 108.72 | -0.57 | -0.96 |
| **32** | 49 | 5.4 | NR | -0.28 | -0.48 |
| **33** | 50.67 | 15.2 | 77 | -0.12 | -0.08 |
| **34** | 57 | 20 | 93 | 0.49 | 0.25 |
| **35** | 47 | 12 | 88.2 | -0.47 | -0.40 |
| **36**** | 0.0482 | 0.0050 | 109 | -5.00 | -18.52 |
| **37** | 53.1 | 15.93 | 117 | 0.12 | 0.07 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 51.9 | 2.8 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 51.9 | 2.8 |
| **Median** | 52.5 | 2.6 |
| **Mean** | 52.4 | |
| **N** | 28 | |
| **Max** | 77.7 | |
| **Min** | 38 | |
| **Robust SD** | 5.8 | |
| **Robust CV** | 11% | |


Kernel Density
Density
Result
Results: S1 - PFBS
Assigned Value = 51.9 ± 2.8 µg/kg
Results (µg/kg)
Laboratory
36 25 18 12 16 31 24 35 2 4 32 10 28 20 33 17 6 21 37 13 19 27 14 9 5 34 1 7 22 23 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFBS
Standard Deviation for Proficiency Assessment 10 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 18 12 16 31 24 35 2 4 32 10 28 20 33 17 6 21 37 13 19 27 14 9 5 34 1 7 22 23

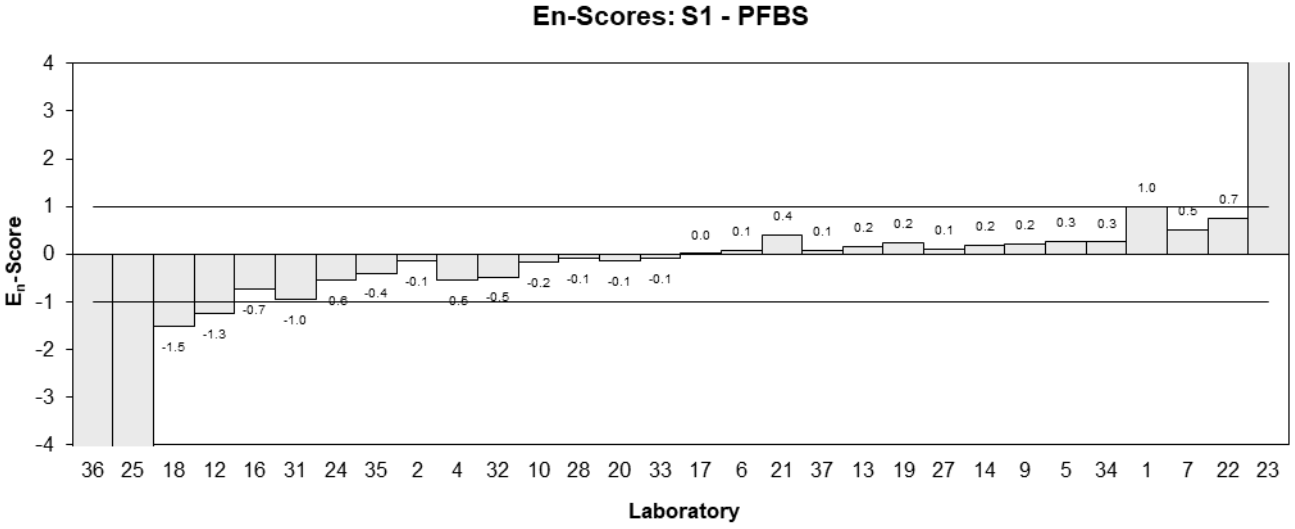

En-Scores: S1 - PFBS
En-Score
Laboratory
36 25 18 12 16 31 24 35 2 4 32 10 28 20 33 17 6 21 37 13 19 27 14 9 5 34 1 7 22 23

Figure 10

Table 14

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFPeS |
| **Unit** | µg/kg |

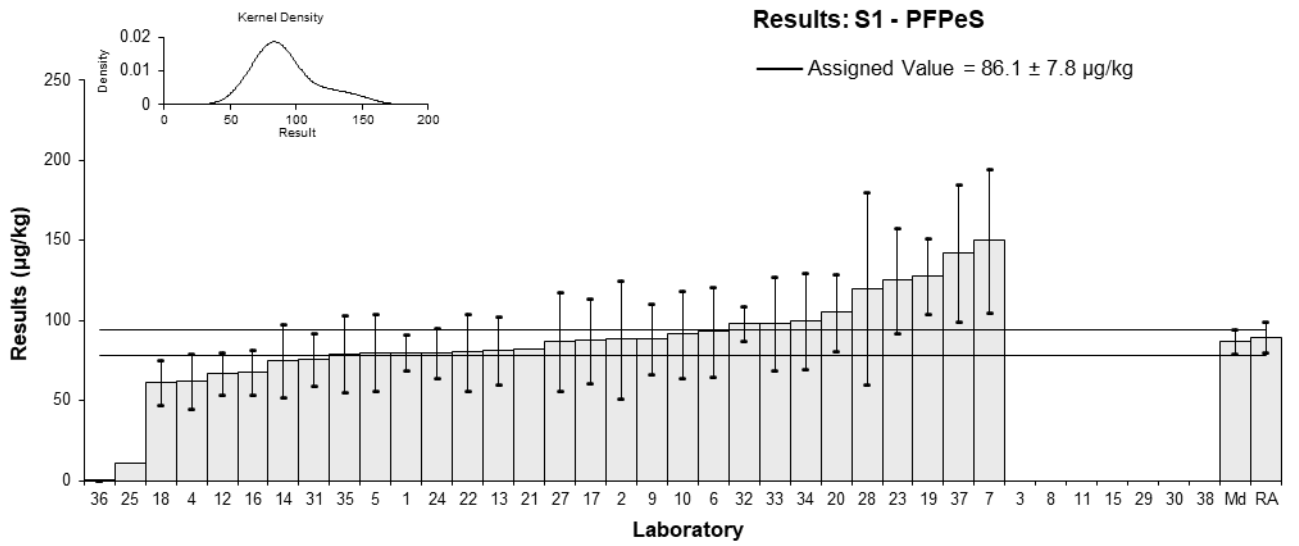
**Participant Results**

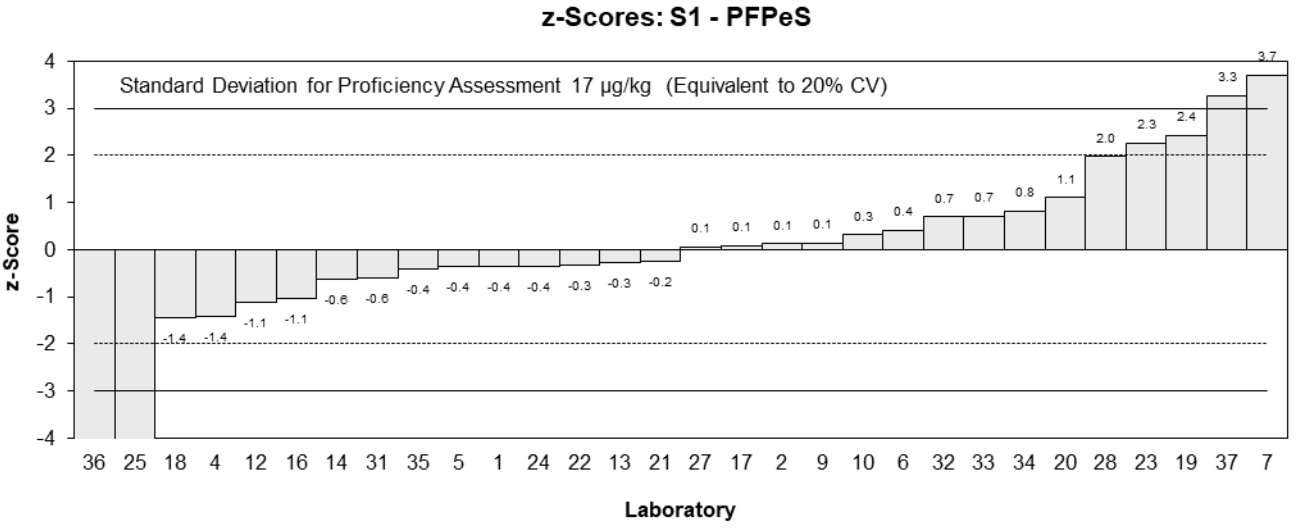
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 80 | 11 | 93 | -0.35 | -0.45 |
| **2** | 88.2 | 37.13 | NR | 0.12 | 0.06 |
| **3** | NT | NT | NT | | |
| **4** | 61.837 | 17.31 | NR | -1.41 | -1.28 |
| **5** | 79.93156 | 23.97946 | 91 | -0.36 | -0.24 |
| **6** | 93 | 27.9 | 84 | 0.40 | 0.24 |
| **7*** | 150 | 45 | NR | 3.71 | 1.40 |
| **8** | NS | NS | NS | | |
| **9** | 88.3 | 22.1 | 105 | 0.13 | 0.09 |
| **10** | 91.5 | 27.45 | 83.5 | 0.31 | 0.19 |
| **11** | NS | NS | NS | | |
| **12** | 67 | 13.4 | NR | -1.11 | -1.23 |
| **13** | 81.1 | 21.09 | NR | -0.29 | -0.22 |
| **14** | 75 | 23 | 69 | -0.64 | -0.46 |
| **15** | NS | NS | NS | | |
| **16** | 68 | 14 | NR | -1.05 | -1.13 |
| **17** | 87.36252 | 26.20875 | 97 | 0.07 | 0.05 |
| **18** | 61.3 | 14.1 | 83 | -1.44 | -1.54 |
| **19** | 128 | 23.7 | 95 | 2.43 | 1.68 |
| **20** | 105 | 24.3 | 99 | 1.10 | 0.74 |
| **21** | 82 | NR | NR | -0.24 | -0.53 |
| **22** | 80.3 | 24.1 | 84 | -0.34 | -0.23 |
| **23** | 125 | 33 | NR | 2.26 | 1.15 |
| **24** | 80.0 | 15.6 | 73.89 | -0.35 | -0.35 |
| **25**** | 11 | NR | NR | -4.36 | -9.63 |
| **27** | 87 | 31 | NT | 0.05 | 0.03 |
| **28** | 120 | 60 | NR | 1.97 | 0.56 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 75.8 | 16.22 | 109.89 | -0.60 | -0.57 |
| **32** | 98 | 11 | NR | 0.69 | 0.88 |
| **33** | 98.12 | 29.4 | NR | 0.70 | 0.40 |
| **34** | 100 | 30 | 91 | 0.81 | 0.45 |
| **35** | 79 | 24 | 95.1 | -0.41 | -0.28 |
| **36**** | 0.0806 | 0.0047 | 91 | -5.00 | -11.03 |
| **37*** | 142.2 | 42.66 | 109 | 3.26 | 1.29 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 86.1 | 7.8 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 89.6 | 9.6 |
| **Median** | 87.2 | 7.6 |
| **Mean** | 91.9 | |
| **N** | 28 | |
| **Max** | 150 | |
| **Min** | 61.3 | |
| **Robust SD** | 20 | |
| **Robust CV** | 23% | |


Kernel Density
Density
Result
Results: S1 - PFPeS
Assigned Value = 86.1 ± 7.8 µg/kg
Results (µg/kg)
Laboratory
36 25 18 4 12 16 14 31 35 5 1 24 22 13 21 27 17 2 9 10 6 32 33 34 20 28 23 19 37 7 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFPeS
Standard Deviation for Proficiency Assessment 17 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 18 4 12 16 14 31 35 5 1 24 22 13 21 27 17 2 9 10 6 32 33 34 20 28 23 19 37 7

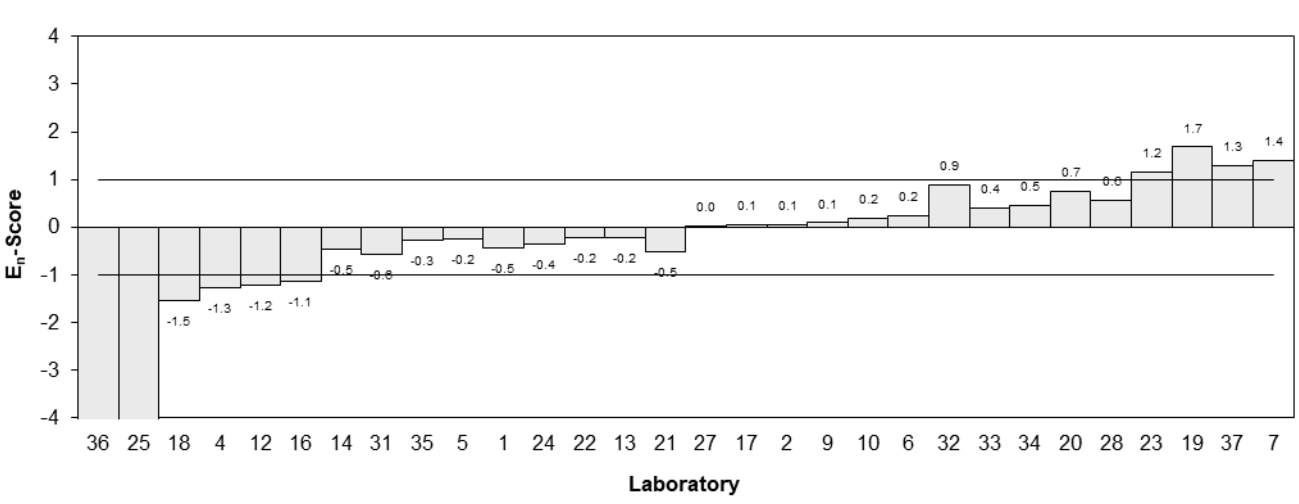

En-Scores: S1 - PFPeS
En-Score
Laboratory
36 25 18 4 12 16 14 31 35 5 1 24 22 13 21 27 17 2 9 10 6 32 33 34 20 28 23 19 37 7

Figure 11

Table 15

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFHxS |
| **Unit** | µg/kg |

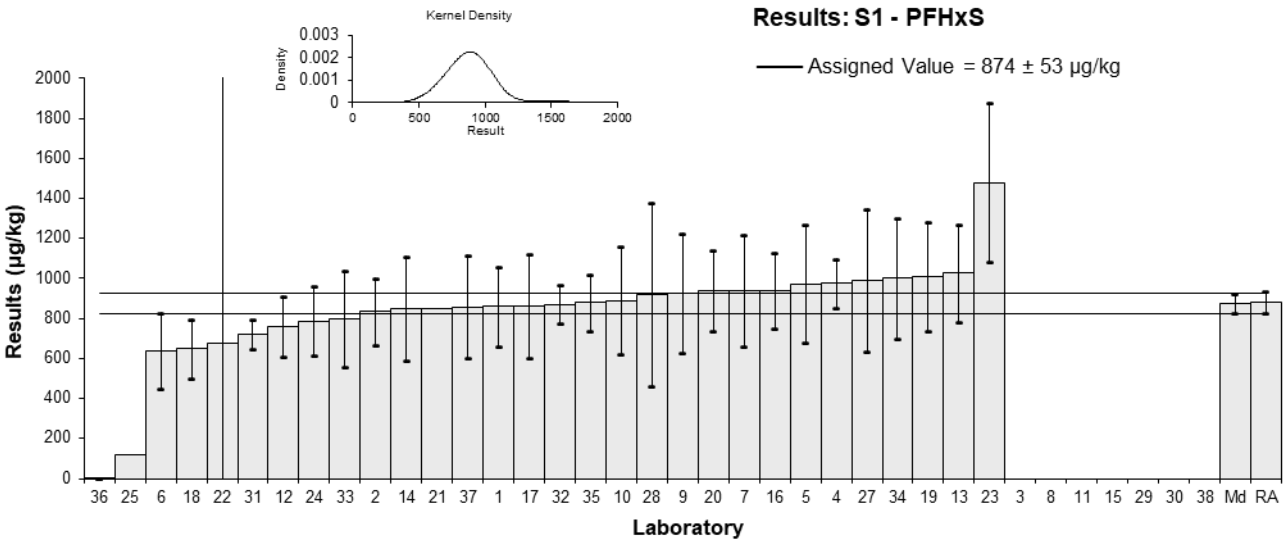
**Participant Results**

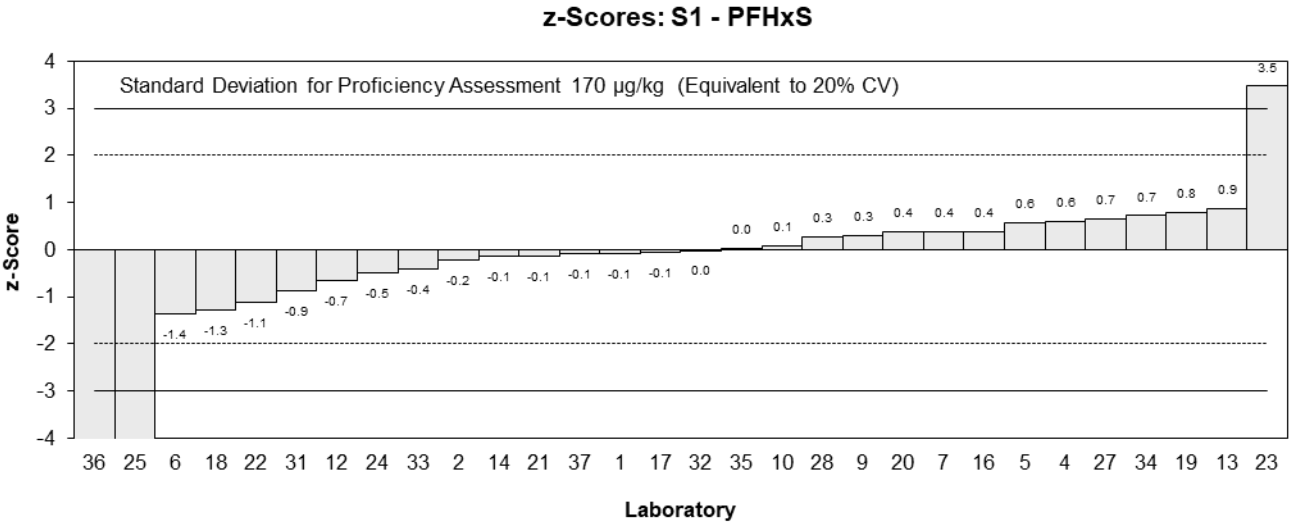
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 860 | 200 | 104 | -0.08 | -0.07 |
| **2** | 835 | 167 | NR | -0.22 | -0.22 |
| **3** | NT | NT | NT | | |
| **4** | 976.56 | 122.15 | 102 | 0.59 | 0.77 |
| **5** | 973.8108 | 292.1432 | 129 | 0.57 | 0.34 |
| **6** | 637 | 191.1 | 102 | -1.36 | -1.20 |
| **7** | 940 | 280 | NR | 0.38 | 0.23 |
| **8** | NS | NS | NS | | |
| **9** | 927 | 297 | 103 | 0.30 | 0.18 |
| **10** | 890 | 267 | 83.5 | 0.09 | 0.06 |
| **11** | NS | NS | NS | | |
| **12** | 760 | 152 | 64 | -0.65 | -0.71 |
| **13** | 1026 | 246 | 80 | 0.87 | 0.60 |
| **14** | 850 | 260 | 69 | -0.14 | -0.09 |
| **15** | NS | NS | NS | | |
| **16** | 940 | 190 | NR | 0.38 | 0.33 |
| **17** | 862.3291 | 258.6987 | 100 | -0.07 | -0.04 |
| **18** | 648.6 | 149.1 | 74 | -1.29 | -1.42 |
| **19** | 1011 | 273 | 96 | 0.78 | 0.49 |
| **20** | 938 | 200.7 | 124 | 0.37 | 0.31 |
| **21** | 850 | NR | 97 | -0.14 | -0.45 |
| **22** | 676 | 2021 | 102 | -1.13 | -0.10 |
| **23*** | 1480 | 400 | 86 | 3.47 | 1.50 |
| **24** | 788 | 173 | 73.89 | -0.49 | -0.48 |
| **25**** | 120 | NR | NR | -4.31 | -14.23 |
| **27** | 990 | 356 | NT | 0.66 | 0.32 |
| **28** | 920 | 460 | 102 | 0.26 | 0.10 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 720 | 72.29 | 109.89 | -0.88 | -1.72 |
| **32** | 870 | 96 | NR | -0.02 | -0.04 |
| **33** | 800.1 | 240 | 114 | -0.42 | -0.30 |
| **34** | 1000 | 300 | 91 | 0.72 | 0.41 |
| **35** | 880 | 141 | 95.1 | 0.03 | 0.04 |
| **36**** | 0.891 | 0.046 | 91 | -4.99 | -16.47 |
| **37** | 858.5 | 257.55 | 91 | -0.09 | -0.06 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 874 | 53 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 880 | 54 |
| **Median** | 875 | 49 |
| **Mean** | 890 | |
| **N** | 28 | |
| **Max** | 1480 | |
| **Min** | 637 | |
| **Robust SD** | 110 | |
| **Robust CV** | 13% | |


Results: S1 - PFHxS
Kernel Density
Density
Result
Assigned Value = 874 ± 53 µg/kg
Results (µg/kg)
Laboratory
36 25 6 18 22 31 12 24 33 2 14 21 37 1 17 32 35 10 28 9 20 7 16 5 4 27 34 19 13 23 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFHxS
Standard Deviation for Proficiency Assessment 170 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 6 18 22 31 12 24 33 2 14 21 37 1 17 32 35 10 28 9 20 7 16 5 4 27 34 19 13 23

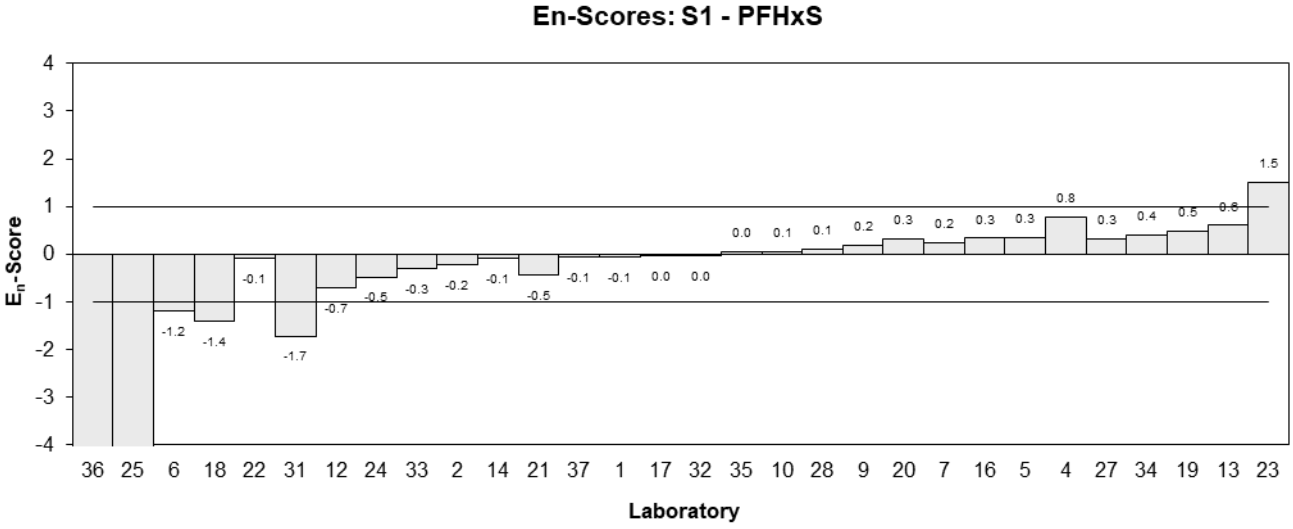

En-Scores: S1 - PFHxS
En-Score
Laboratory
36 25 6 18 22 31 12 24 33 2 14 21 37 1 17 32 35 10 28 9 20 7 16 5 4 27 34 19 13 23

Figure 12

Table 16

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFHxS_L |
| **Unit** | µg/kg |

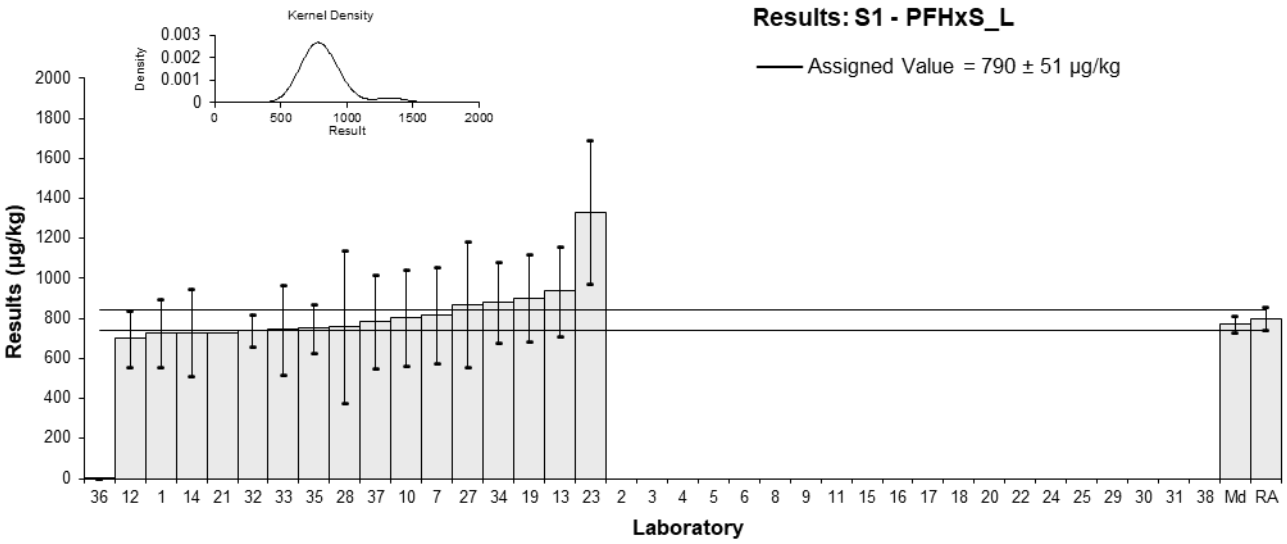
**Participant Results**

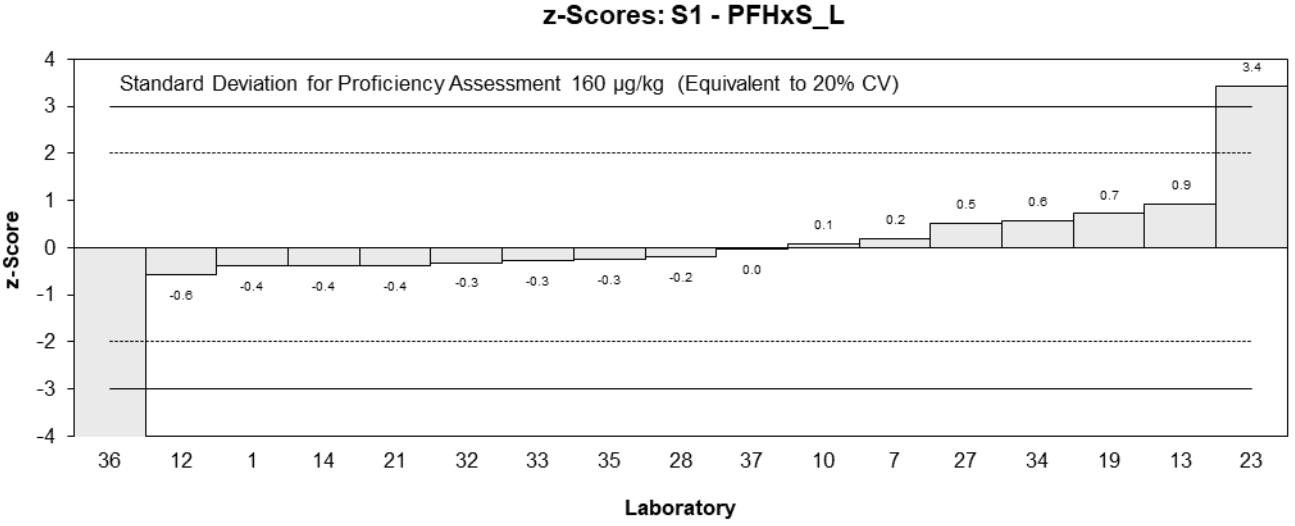
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 730 | 170 | 104 | -0.38 | -0.34 |
| **2** | NT | NT | NT | | |
| **3** | NT | NT | NT | | |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | 820 | 240 | NR | 0.19 | 0.12 |
| **8** | NS | NS | NS | | |
| **9** | NT | NT | NT | | |
| **10** | 805 | 241.5 | 83.5 | 0.09 | 0.06 |
| **11** | NS | NS | NS | | |
| **12** | 700 | 140 | NR | -0.57 | -0.60 |
| **13** | 936 | 225 | NR | 0.92 | 0.63 |
| **14** | 730 | 220 | 69 | -0.38 | -0.27 |
| **15** | NS | NS | NS | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 903 | 217 | 96 | 0.72 | 0.51 |
| **20** | NT | NT | NT | | |
| **21** | 730 | NR | 97 | -0.38 | -1.18 |
| **22** | NT | NT | NT | | |
| **23*** | 1330 | 359 | NR | 3.42 | 1.49 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 870 | 313 | NT | 0.51 | 0.25 |
| **28** | 760 | 380 | NR | -0.19 | -0.08 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | NR | NR | NR | | |
| **32** | 740 | 81 | NR | -0.32 | -0.52 |
| **33** | 745.3 | 224 | 114 | -0.28 | -0.19 |
| **34** | 880 | 200 | 91 | 0.57 | 0.44 |
| **35** | 750 | 120 | 95.1 | -0.25 | -0.31 |
| **36**** | 0.775 | 0.045 | 91 | -5.00 | -15.47 |
| **37** | 783.6 | 235.08 | 91 | -0.04 | -0.03 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 790 | 51 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 801 | 56 |
| **Median** | 772 | 39 |
| **Mean** | 826 | |
| **N** | 16 | |
| **Max** | 1330 | |
| **Min** | 700 | |
| **Robust SD** | 90 | |
| **Robust CV** | 11% | |


Results: S1 - PFHxS_L
Assigned Value = 790 ± 51 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 12 1 14 21 32 33 35 28 37 10 7 27 34 19 13 23 2 3 4 5 6 8 9 11 15 16 17 18 20 22 24 25 29 30 31 38 Md RA


z-Scores: S1 - PFHxS_L
Standard Deviation for Proficiency Assessment 160 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 12 1 14 21 32 33 35 28 37 10 7 27 34 19 13 23
-0.6 -0.4 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 0.0 0.1 0.2 0.5 0.6 0.7 0.9 3.4

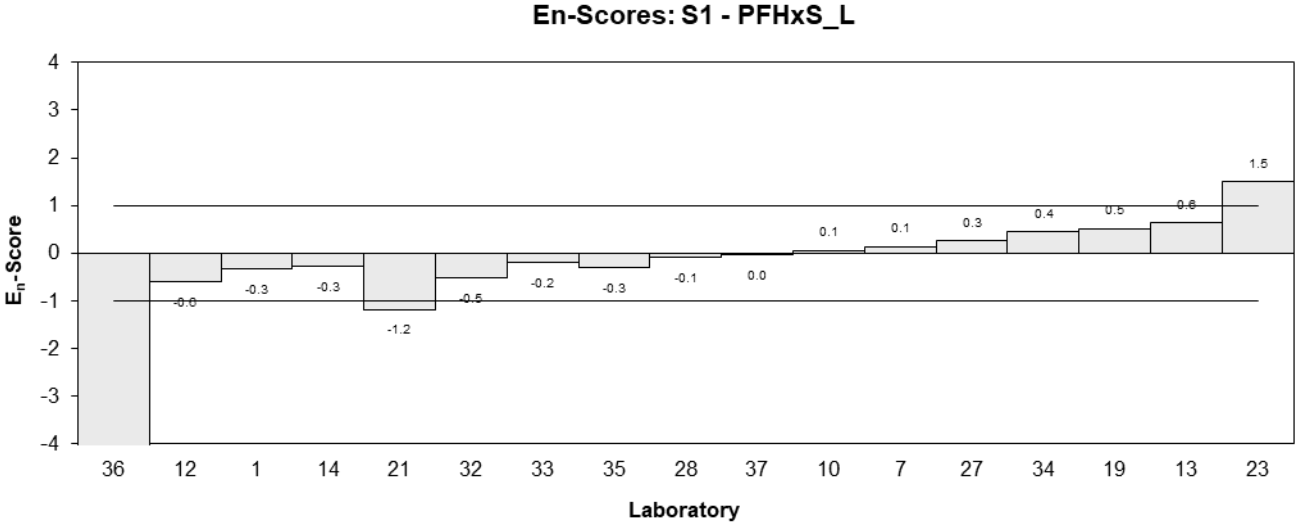

En-Scores: S1 - PFHxS_L
En-Score
Laboratory
36 12 1 14 21 32 33 35 28 37 10 7 27 34 19 13 23
-0.6 -0.3 -0.3 -1.2 -0.5 -0.2 -0.3 -0.1 0.0 0.1 0.1 0.3 0.4 0.5 0.6 1.5

Figure 13

Table 17

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFHpS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | 110 | 18 | 104 |
| **2** | 141 | 54.71 | NR |
| **3** | NT | NT | NT |
| **4** | 84.877 | 24.98 | NR |
| **5** | 133.961 | 40.1883 | 118 |
| **6** | 220 | 66 | 118 |
| **7** | 250 | 75 | NR |
| **8** | NS | NS | NS |
| **9** | 164 | 44 | 93 |
| **10** | 145 | 43.5 | 83.5 |
| **11** | NS | NS | NS |
| **12** | 110 | 22 | NR |
| **13** | 238 | 62 | NR |
| **14** | 230 | 69 | 86 |
| **15** | NS | NS | NS |
| **16** | 110 | 22 | NR |
| **17** | 130.5812 | 39.17437 | 56 |
| **18** | 86.6 | 19.9 | 74 |
| **19** | 248 | 44.3 | 96 |
| **20** | 209 | 45.9 | 78 |
| **21** | 140 | NR | NR |
| **22** | NR | 0 | 118 |
| **23** | 239 | 65 | NR |
| **24** | 143 | 29 | 81.09 |
| **25**** | 19 | NR | NR |
| **27** | 150 | 54 | NT |
| **28** | 140 | 70 | NR |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 138 | 30.08 | 109.89 |
| **32** | 210 | 22 | NR |
| **33** | 212.0 | 63.6 | NR |
| **34** | 180 | 40 | 90 |
| **35** | 120 | 42 | 95.1 |
| **36**** | 0.162 | 0.013 | 89 |
| **37** | 256.1 | 76.83 | 107 |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 168 | 30 |
| **Median** | 145 | 25 |
| **Mean** | 168 | |
| **N** | 27 | |
| **Max** | 256.1 | |
| **Min** | 84.877 | |
| **Robust SD** | 61 | |
| **Robust CV** | 36% | |

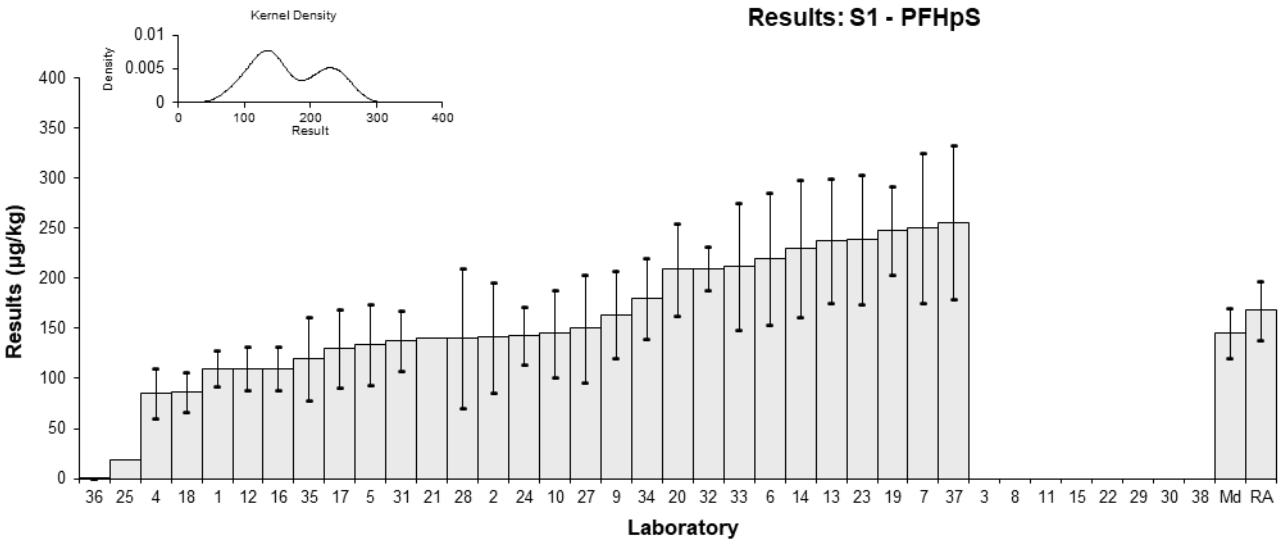

Results: S1 - PFHpS
Kernel Density
Density
0.01
0.005
0
0
100
200
300
400
Result
Results (µg/kg)
400
350
300
250
200
150
100
50
0
36 25 4 18 1 12 16 35 17 5 31 21 28 2 24 10 27 9 34 20 32 33 6 14 13 23 19 7 37 3 8 11 15 22 29 30 38 Md RA
Laboratory

Figure 14

Table 18

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFOS |
| **Unit** | µg/kg |

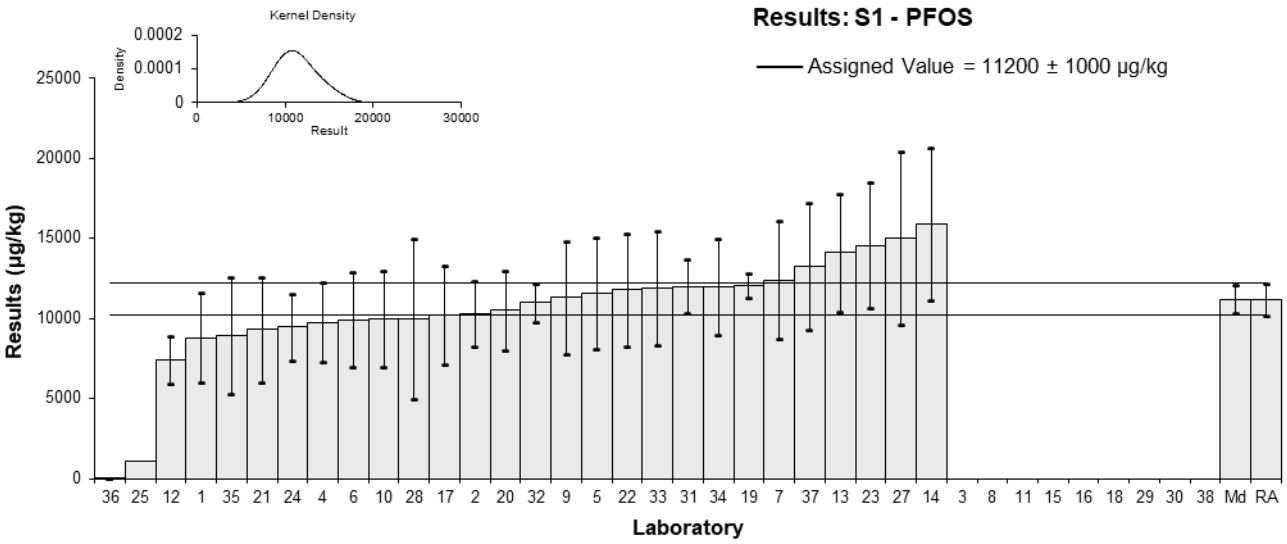
**Participant Results**

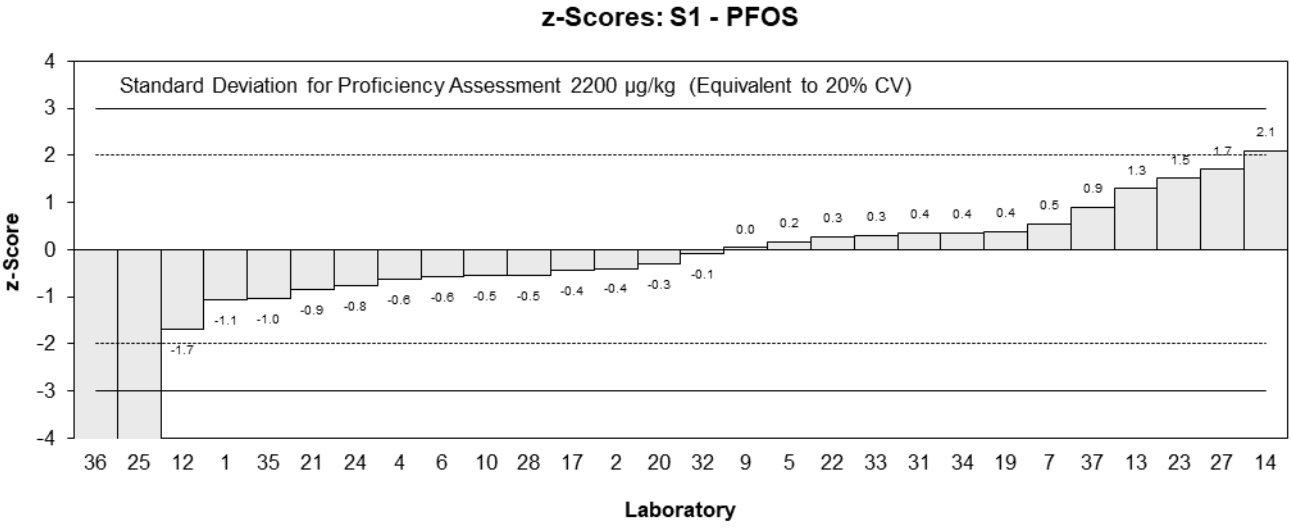
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 8800 | 2800 | 106 | -1.07 | -0.81 |
| **2** | 10300 | 2060 | NR | -0.40 | -0.39 |
| **3** | NT | NT | NT | | |
| **4** | 9755.34 | 2496.35 | 126 | -0.64 | -0.54 |
| **5** | 11557.79 | 3467.338 | 93 | 0.16 | 0.10 |
| **6** | 9912 | 2973.6 | 95 | -0.57 | -0.41 |
| **7** | 12400 | 3700 | NR | 0.54 | 0.31 |
| **8** | NS | NS | NS | | |
| **9** | 11300 | 3503 | 101 | 0.04 | 0.03 |
| **10** | 10000 | 3000 | 107.2 | -0.54 | -0.38 |
| **11** | NS | NS | NS | | |
| **12** | 7400 | 1500 | 101 | -1.70 | -2.11 |
| **13** | 14099 | 3666 | 93 | 1.29 | 0.76 |
| **14** | 15900 | 4770 | 86 | 2.10 | 0.96 |
| **15** | NS | NS | NS | | |
| **16** | > 10000 | NR | NR | | |
| **17** | 10233.86 | 3070.160 | 107 | -0.43 | -0.30 |
| **18** | NT | NT | NT | | |
| **19** | 12080 | 751 | 103 | 0.39 | 0.70 |
| **20** | 10500 | 2457 | 105 | -0.31 | -0.26 |
| **21** | 9300 | 3255 | 95 | -0.85 | -0.56 |
| **22** | 11779 | 3534 | 95 | 0.26 | 0.16 |
| **23** | 14579 | 3954 | 115 | 1.51 | 0.83 |
| **24** | 9460 | 2060 | 81.09 | -0.78 | -0.76 |
| **25**** | 1100 | NR | NR | -4.51 | -10.10 |
| **27** | 15000 | 5400 | NT | 1.70 | 0.69 |
| **28** | 10000 | 5000 | 94 | -0.54 | -0.24 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 12000 | 1684.8 | 75.2 | 0.36 | 0.41 |
| **32** | 11000 | 1200 | NR | -0.09 | -0.13 |
| **33** | 11881 | 3564 | 94 | 0.30 | 0.18 |
| **34** | 12000 | 3000 | 90 | 0.36 | 0.25 |
| **35** | 8900 | 3649 | 97.0 | -1.03 | -0.61 |
| **36**** | 10.74 | 0.52 | 89 | -5.00 | -11.19 |
| **37** | 13220.8 | 3966.24 | 107 | 0.90 | 0.49 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 11200 | 1000 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 11200 | 1000 |
| **Median** | 11200 | 900 |
| **Mean** | 11300 | |
| **N** | 26 | |
| **Max** | 15900 | |
| **Min** | 7400 | |
| **Robust SD** | 2000 | |
| **Robust CV** | 18% | |


Results: S1 - PFOS
Assigned Value = 11200 ± 1000 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 25 12 1 35 21 24 4 6 10 28 17 2 20 32 9 5 22 33 31 34 19 7 37 13 23 27 14 3 8 11 15 16 18 29 30 38 Md RA


z-Scores: S1 - PFOS
Standard Deviation for Proficiency Assessment 2200 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 12 1 35 21 24 4 6 10 28 17 2 20 32 9 5 22 33 31 34 19 7 37 13 23 27 14

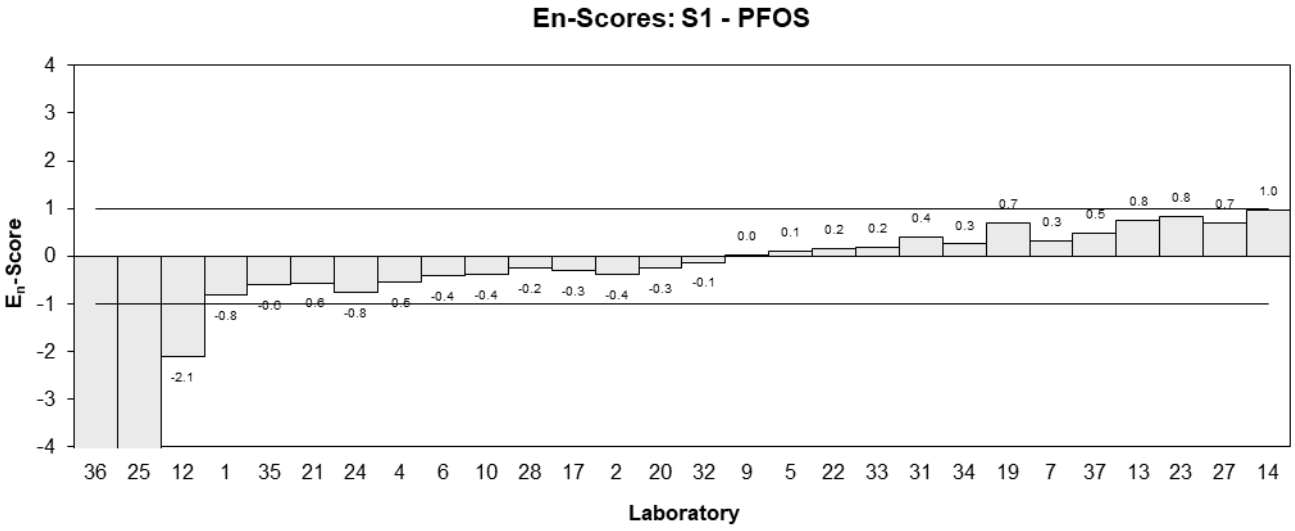

En-Scores: S1 - PFOS
En-Score
Laboratory
36 25 12 1 35 21 24 4 6 10 28 17 2 20 32 9 5 22 33 31 34 19 7 37 13 23 27 14

Figure 15

Table 19

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFOS_L |
| **Unit** | µg/kg |

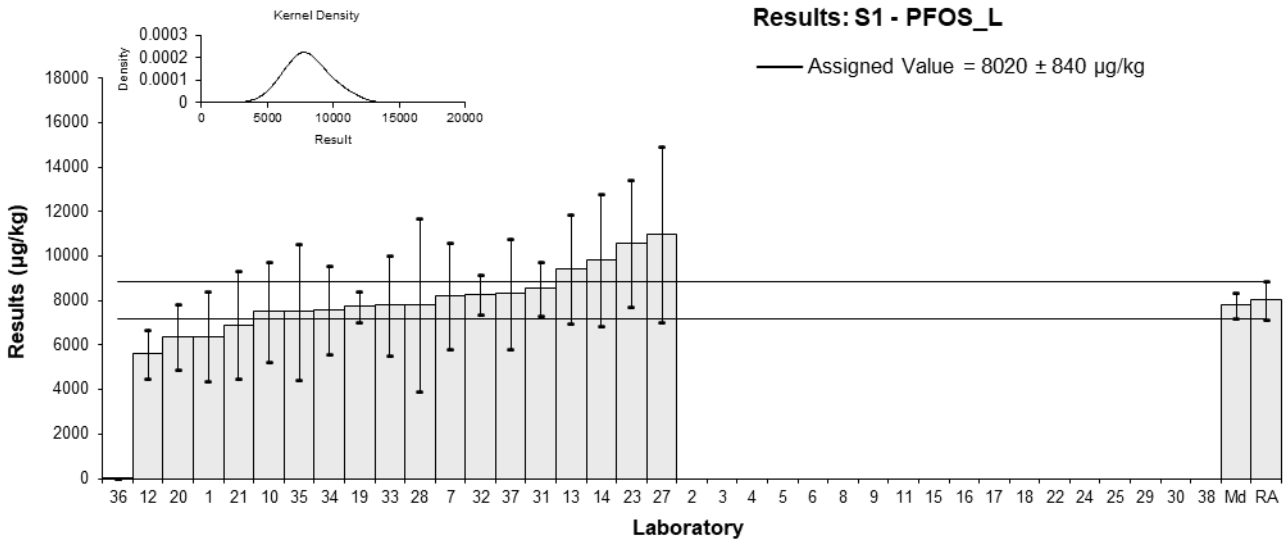
**Participant Results**

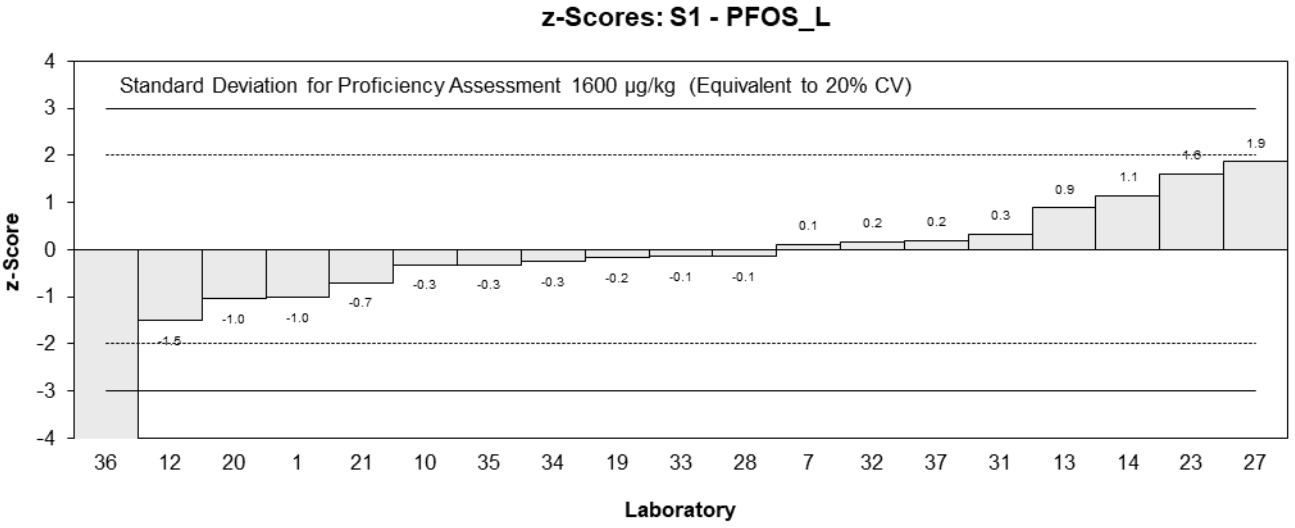
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 6400 | 2000 | 106 | -1.01 | -0.75 |
| **2** | NT | NT | NT | | |
| **3** | NT | NT | NT | | |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | 8200 | 2400 | NR | 0.11 | 0.07 |
| **8** | NS | NS | NS | | |
| **9** | NT | NT | NT | | |
| **10** | 7500 | 2250 | 107.2 | -0.32 | -0.22 |
| **11** | NS | NS | NS | | |
| **12** | 5600 | 1100 | NR | -1.51 | -1.75 |
| **13** | 9430 | 2452 | NR | 0.88 | 0.54 |
| **14** | 9830 | 2950 | 86 | 1.13 | 0.59 |
| **15** | NS | NS | NS | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 7740 | 690 | 103 | -0.17 | -0.26 |
| **20** | 6370 | 1490 | 105 | -1.03 | -0.96 |
| **21** | 6900 | 2415 | 95 | -0.70 | -0.44 |
| **22** | NT | NT | NT | | |
| **23** | 10580 | 2857 | NR | 1.60 | 0.86 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 11000 | 3960 | NT | 1.86 | 0.74 |
| **28** | 7800 | 3900 | NR | -0.14 | -0.06 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 8550 | 1200.4 | 75.2 | 0.33 | 0.36 |
| **32** | 8300 | 890 | NR | 0.17 | 0.23 |
| **33** | 7788 | 2236 | 94 | -0.14 | -0.10 |
| **34** | 7600 | 2000 | 90 | -0.26 | -0.19 |
| **35** | 7500 | 3075 | 97.0 | -0.32 | -0.16 |
| **36**** | 7.58 | 0.48 | 89 | -5.00 | -9.54 |
| **37** | 8315.21 | 2494.56 | 110 | 0.18 | 0.11 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 8020 | 840 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 8020 | 840 |
| **Median** | 7790 | 560 |
| **Mean** | 8080 | |
| **N** | 18 | |
| **Max** | 11000 | |
| **Min** | 5600 | |
| **Robust SD** | 1400 | |
| **Robust CV** | 18% | |


Results: S1 - PFOS_L
Assigned Value = 8020 ± 840 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 12 20 1 21 10 35 34 19 33 28 7 32 37 31 13 14 23 27 2 3 4 5 6 8 9 11 15 16 17 18 22 24 25 29 30 38 Md RA


z-Scores: S1 - PFOS_L
Standard Deviation for Proficiency Assessment 1600 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 12 20 1 21 10 35 34 19 33 28 7 32 37 31 13 14 23 27

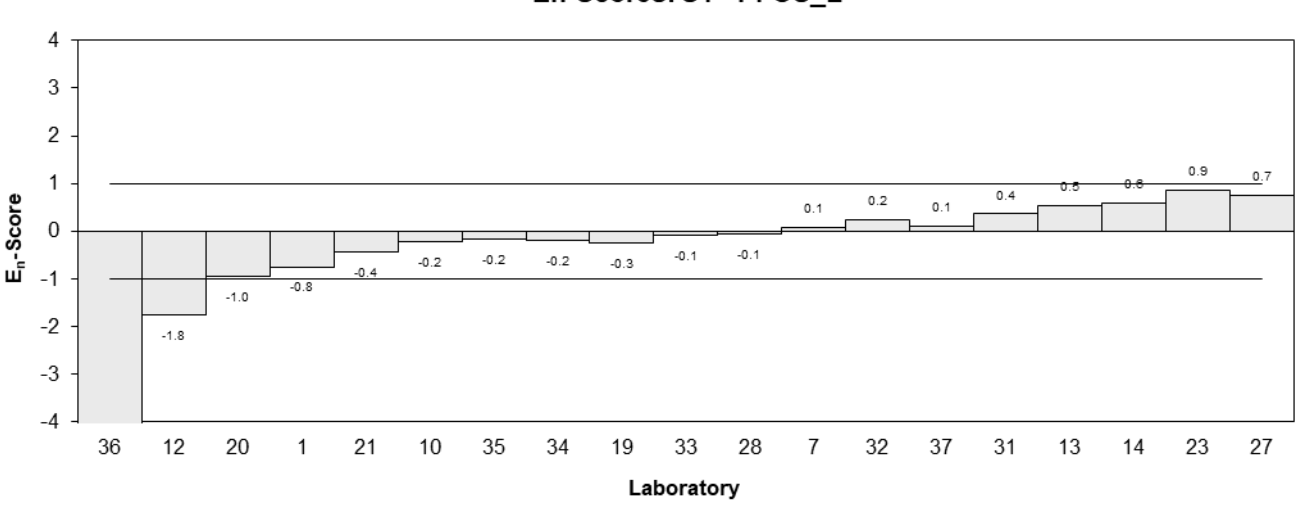

En-Scores: S1 - PFOS_L
En-Score
Laboratory
36 12 20 1 21 10 35 34 19 33 28 7 32 37 31 13 14 23 27

Figure 16

Table 20

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFNS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | 13 | 2 | 106 |
| **2** | 67.9 | 14.26 | NR |
| **3** | NT | NT | NT |
| **4** | 10.583 | 3.81 | NR |
| **5** | NT | NT | NT |
| **6** | 56 | 16.8 | 102 |
| **7** | 150 | 45 | NR |
| **8** | NS | NS | NS |
| **9** | 80.3 | 24.1 | 100 |
| **10** | 28 | 8.4 | 107.2 |
| **11** | NS | NS | NS |
| **12** | 31 | 6.2 | NR |
| **13** | <1 | NR | NR |
| **14** | 85 | 26 | 86 |
| **15** | NS | NS | NS |
| **16** | 12 | 2 | NR |
| **17** | NT | NT | NT |
| **18** | 12.9 | 3 | 25 |
| **19** | 33.1 | 6.17 | 122 |
| **20** | 102 | NR | 78 |
| **21** | 12 | NR | NR |
| **22** | 44.3 | 13.3 | 102 |
| **23** | 12.7 | 3.9 | NR |
| **24** | 75.1 | 15.0 | 81.09 |
| **25** | NT | NT | NT |
| **27** | 31 | 11 | NT |
| **28** | 42 | 21 | NR |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 45.6 | NR | 75.2 |
| **32** | <50 | NR | NR |
| **33** | 41.67 | 12.5 | NR |
| **34** | 74 | 20 | 90 |
| **35** | 9.7 | 2.2 | 91.6 |
| **36**** | 0.01064 | 0.00077 | 89 |
| **37** | 84.12 | 25.24 | 96 |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 46 | 17 |
| **Median** | 42 | 22 |
| **Mean** | 48 | |
| **N** | 24 | |
| **Max** | 150 | |
| **Min** | 9.7 | |
| **Robust SD** | 34 | |
| **Robust CV** | 74% | |

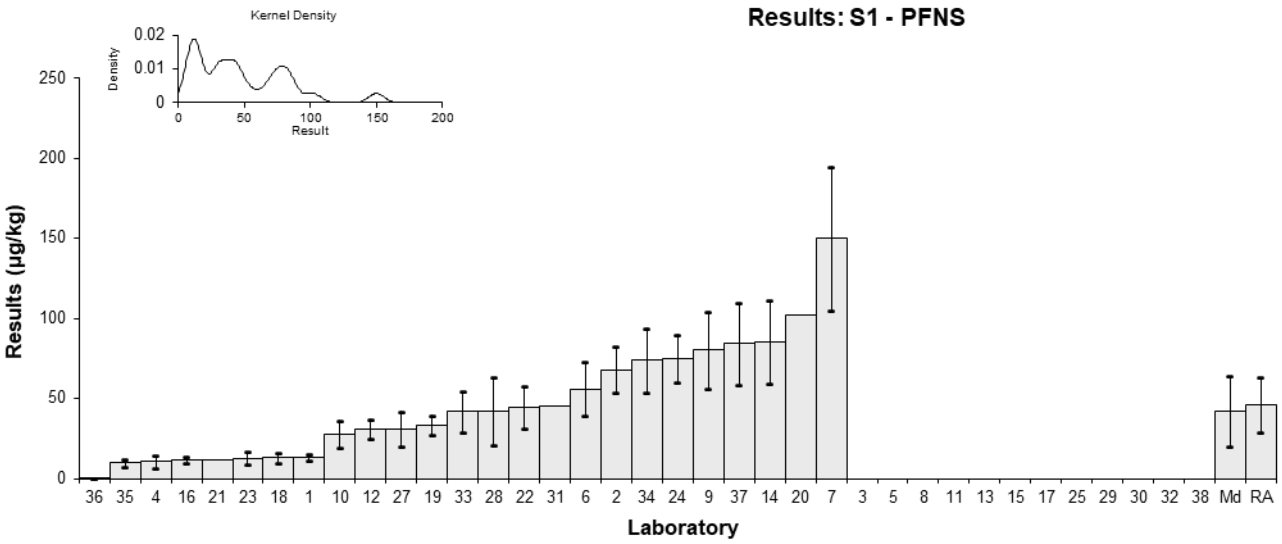

Results: S1 - PFNS
Kernel Density
Density
0.02
0.01
0
0
50
100
150
200
Result
Results (µg/kg)
250
200
150
100
50
0
36 35 4 16 21 23 18 1 10 12 27 19 33 28 22 31 6 2 34 24 9 37 14 20 7 3 5 8 11 13 15 17 25 29 30 32 38 Md RA
Laboratory

Figure 17

Table 21

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFDS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | 6.2 | 1.5 | 106 |
| **2** | 15 | 4.82 | NR |
| **3** | NT | NT | NT |
| **4** | 3.186 | 0.86 | NR |
| **5** | 2.94851 | 0.884553 | 109 |
| **6** | <0.001 | NR | NR |
| **7** | 42 | 12 | NR |
| **8** | NS | NS | NS |
| **9** | 22.3 | 7.4 | 92 |
| **10** | 13.5 | 4.05 | 107.2 |
| **11** | NS | NS | NS |
| **12** | 13 | 2.6 | NR |
| **13** | <1 | NR | NR |
| **14** | 26 | 7.8 | 86 |
| **15** | NS | NS | NS |
| **16** | 9 | 2 | NR |
| **17** | 2.727738 | 0.818321 | NR |
| **18** | 5.6 | 1.3 | 25 |
| **19** | 8.11 | 1.1 | 122 |
| **20** | 24.8 | 6.25 | 78 |
| **21** | 3.5 | NR | NR |
| **22** | <0.001 | NR | NR |
| **23** | 5.6 | 1.8 | NR |
| **24** | 19.8 | 4.0 | 81.09 |
| **25** | <5 | NR | NR |
| **27** | 3.0 | 1.1 | NT |
| **28** | 12 | 6 | NR |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 23 | 3.49 | 75.2 |
| **32** | <10 | NR | NR |
| **33** | 19.13 | 5.74 | NR |
| **34** | 22 | 5 | 90 |
| **35** | 4.0 | 1.2 | 91.6 |
| **36**** | 0.00859 | 0.00069 | 89 |
| **37** | 3.82 | 1.15 | 104 |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 12.3 | 5.0 |
| **Median** | 10.5 | 5.4 |
| **Mean** | 12.9 | |
| **N** | 24 | |
| **Max** | 42 | |
| **Min** | 2.727738 | |
| **Robust SD** | 9.8 | |
| **Robust CV** | 79% | |

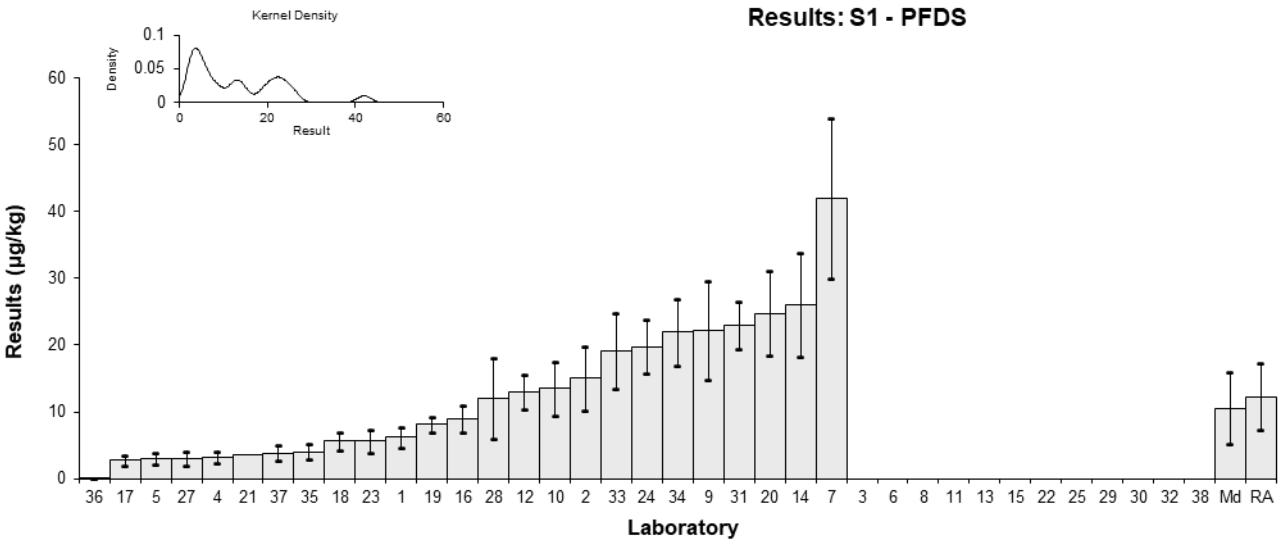

Results: S1 - PFDS
Kernel Density
Density
0.1
0.05
0
0
20
40
60
Result
Results (µg/kg)
60
50
40
30
20
10
0
36 17 5 27 4 21 37 35 18 23 1 19 16 28 12 10 2 33 24 34 9 31 20 14 7 3 6 8 11 13 15 22 25 29 30 32 38 Md RA
Laboratory

Figure 18

Table 22

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFDoS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | 12.2 | 9.49 | NR |
| **3** | NT | NT | NT |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | <0.001 | NR | NR |
| **7** | NT | NT | NT |
| **8** | NS | NS | NS |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | NS | NS | NS |
| **12** | 10 | 2 | NR |
| **13** | <1 | NR | NR |
| **14** | NT | NT | NT |
| **15** | NS | NS | NS |
| **16** | 7.7 | 1.5 | NR |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 3.12 | 1.2 | 122 |
| **20** | 21.1 | NR | 61 |
| **21** | 5.6 | NR | NR |
| **22** | <0.001 | NR | NR |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 3.2 | 1.2 | NT |
| **28** | 49 | 25 | NR |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 4.2 | NR | 115.83 |
| **32** | <10 | NR | NR |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | 3.8 | 1.824 | 91.6 |
| **36**** | 0.00722 | 0.00037 | 89 |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 9.1 | 6.1 |
| **Median** | 6.7 | 4.0 |
| **Mean** | 12.0 | |
| **N** | 10 | |
| **Max** | 49 | |
| **Min** | 3.12 | |
| **Robust SD** | 7.7 | |
| **Robust CV** | 84% | |

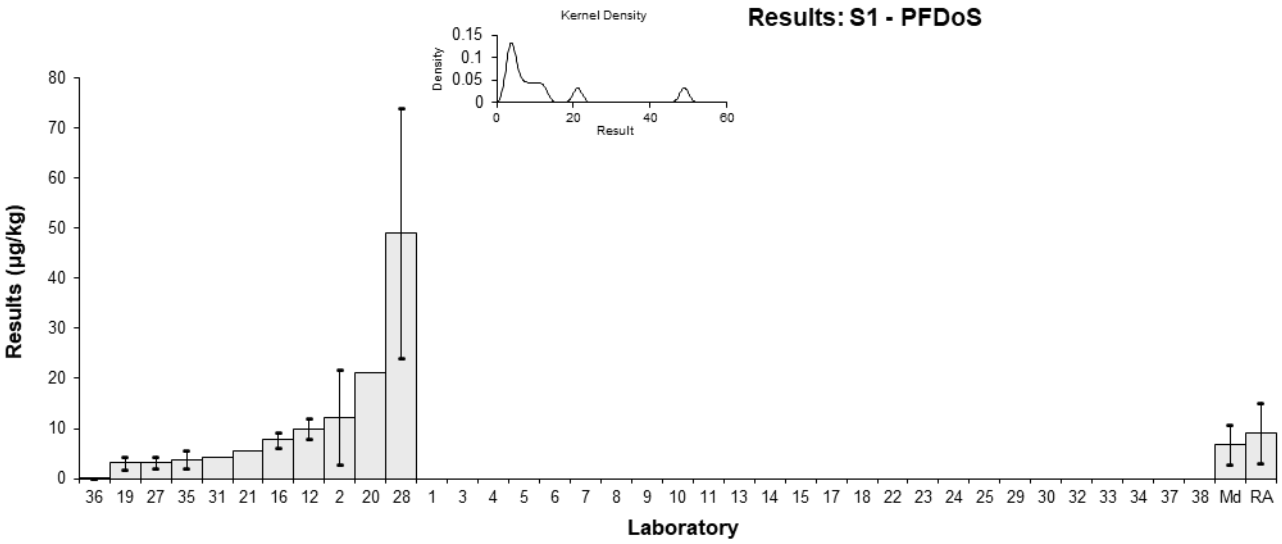

Results: S1 - PFDoS
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 19 27 35 31 21 16 12 2 20 28 1 3 4 5 6 7 8 9 10 11 13 14 15 17 18 22 23 24 25 29 30 32 33 34 37 38 Md RA

Figure 19

Table 23

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | PFOSA |
| **Unit** | µg/kg |

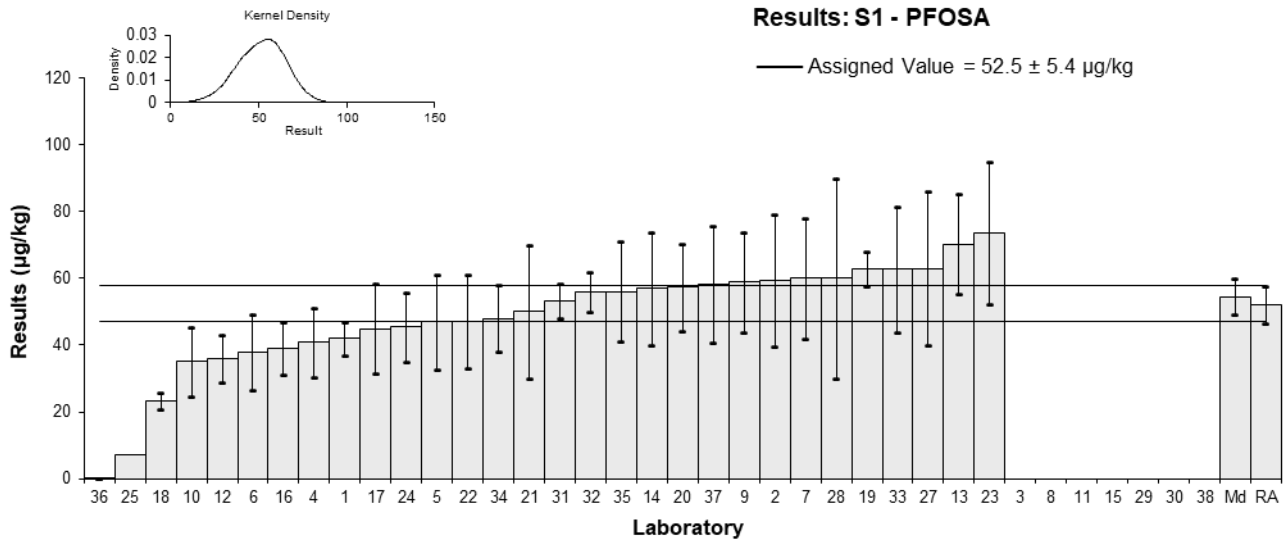
**Participant Results**

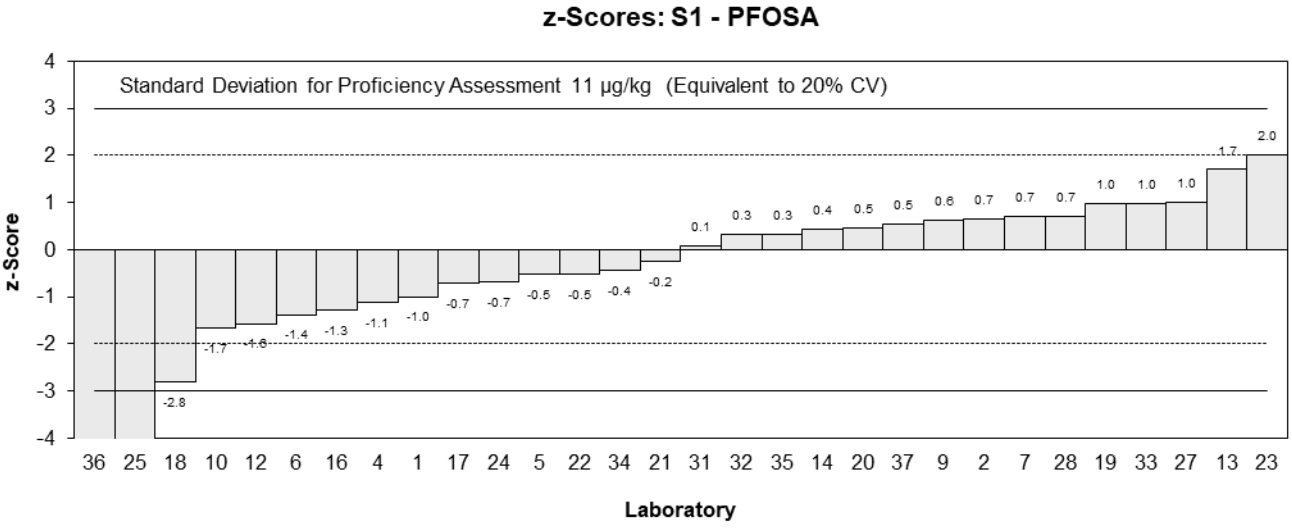
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 42 | 5.0 | 100 | -1.00 | -1.43 |
| **2** | 59.4 | 19.74 | NR | 0.66 | 0.34 |
| **3** | NT | NT | NT | | |
| **4** | 40.833 | 10.35 | 89 | -1.11 | -1.00 |
| **5** | 46.96623 | 14.08986 | 79 | -0.53 | -0.37 |
| **6** | 38 | 11.4 | 100 | -1.38 | -1.15 |
| **7** | 60 | 18 | NR | 0.71 | 0.40 |
| **8** | NS | NS | NS | | |
| **9** | 59 | 15 | 101 | 0.62 | 0.41 |
| **10** | 35 | 10.5 | 110 | -1.67 | -1.48 |
| **11** | NS | NS | NS | | |
| **12** | 36 | 7.2 | 101 | -1.57 | -1.83 |
| **13** | 70.36 | 15 | 76 | 1.70 | 1.12 |
| **14** | 57 | 17 | 90 | 0.43 | 0.25 |
| **15** | NS | NS | NS | | |
| **16** | 39 | 8 | NR | -1.29 | -1.40 |
| **17** | 44.97126 | 13.49138 | 82 | -0.72 | -0.52 |
| **18*** | 23.1 | 2.5 | 109 | -2.80 | -4.94 |
| **19** | 62.7 | 5.2 | 71 | 0.97 | 1.36 |
| **20** | 57.3 | 13 | 121 | 0.46 | 0.34 |
| **21** | 50 | 20 | 95 | -0.24 | -0.12 |
| **22** | 47 | 14.1 | 100 | -0.52 | -0.36 |
| **23** | 73.6 | 21.3 | 89 | 2.01 | 0.96 |
| **24** | 45.4 | 10.4 | 95.16 | -0.68 | -0.61 |
| **25**** | 7 | NR | NR | -4.33 | -8.43 |
| **27** | 63 | 23 | NT | 1.00 | 0.44 |
| **28** | 60 | 30 | 96 | 0.71 | 0.25 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 53.2 | 5.21 | 104.75 | 0.07 | 0.09 |
| **32** | 56 | 5.9 | NR | 0.33 | 0.44 |
| **33** | 62.76 | 18.8 | 75 | 0.98 | 0.52 |
| **34** | 48 | 10 | 110 | -0.43 | -0.40 |
| **35** | 56 | 15 | 92.8 | 0.33 | 0.22 |
| **36**** | 0.0546 | 0.0044 | 100 | -4.99 | -9.71 |
| **37** | 58.15 | 17.45 | 98 | 0.54 | 0.31 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 52.5 | 5.4 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 52.2 | 5.5 |
| **Median** | 54.6 | 5.5 |
| **Mean** | 51.6 | |
| **N** | 28 | |
| **Max** | 73.6 | |
| **Min** | 23.1 | |
| **Robust SD** | 12 | |
| **Robust CV** | 22% | |


Kernel Density
Density
Result
Results: S1 - PFOSA
Assigned Value = 52.5 ± 5.4 µg/kg
Results (µg/kg)
Laboratory
36 25 18 10 12 6 16 4 1 17 24 5 22 34 21 31 32 35 14 20 37 9 2 7 28 19 33 27 13 23 3 8 11 15 29 30 38 Md RA


z-Scores: S1 - PFOSA
Standard Deviation for Proficiency Assessment 11 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 18 10 12 6 16 4 1 17 24 5 22 34 21 31 32 35 14 20 37 9 2 7 28 19 33 27 13 23

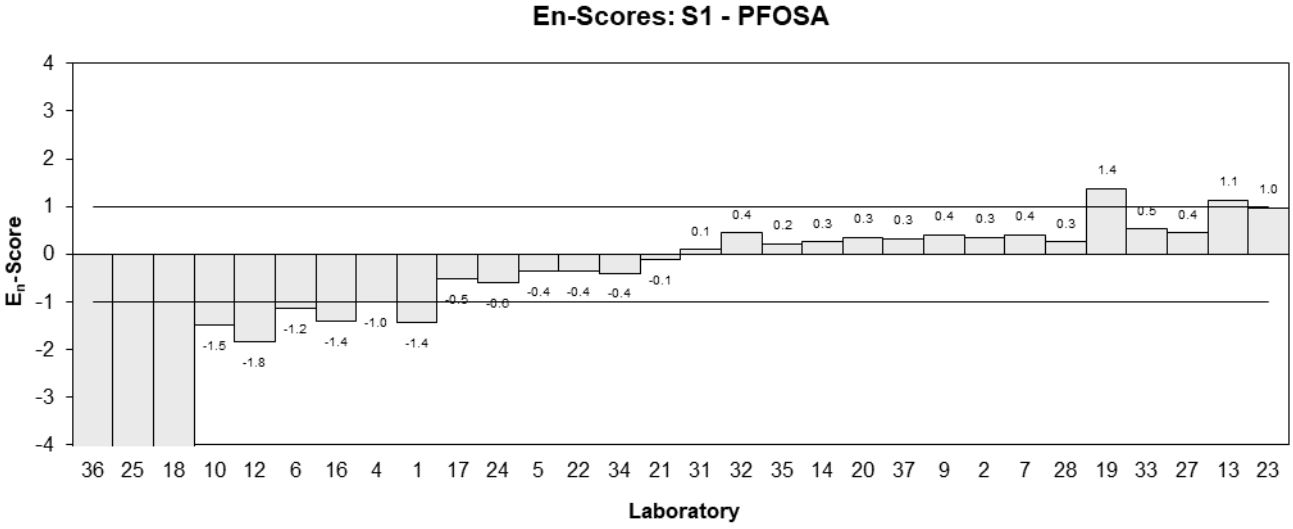

En-Scores: S1 - PFOSA
En-Score
Laboratory
36 25 18 10 12 6 16 4 1 17 24 5 22 34 21 31 32 35 14 20 37 9 2 7 28 19 33 27 13 23

Figure 20

Table 24

**Sample Details**

| | |
|---|---|
| **Sample No.** | S1 |
| **Matrix** | Soil |
| **Analyte** | MeFOSAA |
| **Unit** | µg/kg |

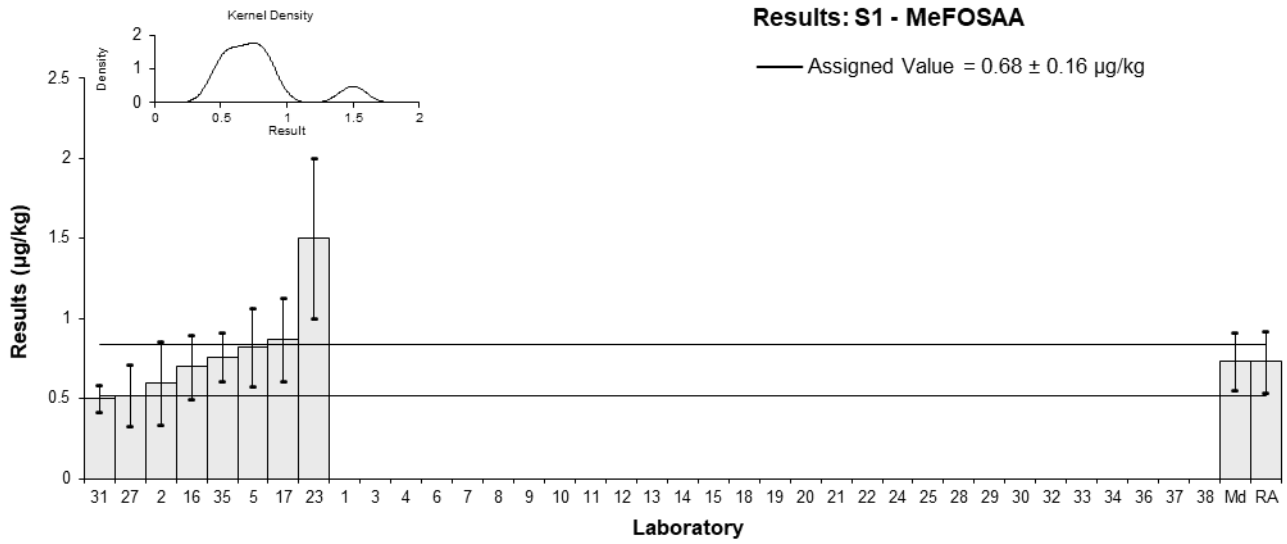
**Participant Results**

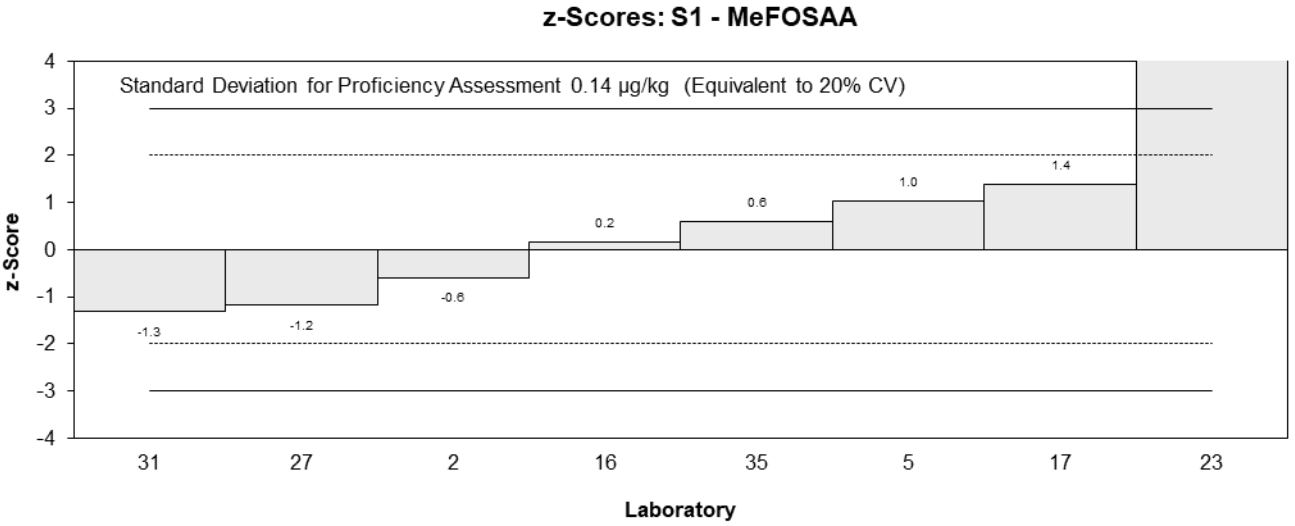
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <1.0 | NR | 105 | | |
| **2** | 0.6 | 0.26 | NR | -0.59 | -0.26 |
| **3** | NT | NT | NT | | |
| **4** | <0.3 | 0.3 | 108 | | |
| **5** | 0.82169 | 0.246507 | 56 | 1.04 | 0.48 |
| **6** | <0.001 | NR | NR | | |
| **7** | <5 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | <2 | NR | NR | | |
| **10** | <1 | NR | 43 | | |
| **11** | NS | NS | NS | | |
| **12** | NR | NR | NR | | |
| **13** | <1 | NR | NR | | |
| **14** | < 1 | NR | 89 | | |
| **15** | NS | NS | NS | | |
| **16** | 0.7 | 0.2 | NR | 0.15 | 0.08 |
| **17** | 0.868488 | 0.260546 | 65 | 1.39 | 0.62 |
| **18** | <5 | NR | NR | | |
| **19** | <1 | NR | 32 | | |
| **20** | <0.5 | NR | 129 | | |
| **21** | <1.0 | NR | 85 | | |
| **22** | <0.001 | NR | NR | | |
| **23*** | 1.5 | 0.5 | 82 | 6.03 | 1.56 |
| **24** | <9.9 | NR | 63.48 | | |
| **25** | <5 | NR | NR | | |
| **27** | 0.52 | 0.19 | NT | -1.18 | -0.64 |
| **28** | < 5 | 2.5 | 110 | | |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 0.5 | 0.085 | 106.54 | -1.32 | -0.99 |
| **32** | <10 | NR | NR | | |
| **33** | < 0.5 | NR | 138 | | |
| **34** | <2 | NR | 86 | | |
| **35** | 0.76 | 0.152 | 92.9 | 0.59 | 0.36 |
| **36** | < 0.0010 | 0.000078 | 94 | | |
| **37** | <1 | NR | 91 | | |
| **38** | NS | NS | NS | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 0.68 | 0.16 |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 0.73 | 0.19 |
| **Median** | 0.73 | 0.18 |
| **Mean** | 0.78 | |
| **N** | 8 | |
| **Max** | 1.5 | |
| **Min** | 0.5 | |
| **Robust SD** | 0.21 | |
| **Robust CV** | 29% | |


Results: S1 - MeFOSAA
Assigned Value = 0.68 ± 0.16 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
31 27 2 16 35 5 17 23 1 3 4 6 7 8 9 10 11 12 13 14 15 18 19 20 21 22 24 25 28 29 30 32 33 34 36 37 38 Md RA


z-Scores: S1 - MeFOSAA
Standard Deviation for Proficiency Assessment 0.14 µg/kg (Equivalent to 20% CV)
z-Score
-1.3
-1.2
-0.6
0.2
0.6
1.0
1.4
Laboratory
31 27 2 16 35 5 17 23

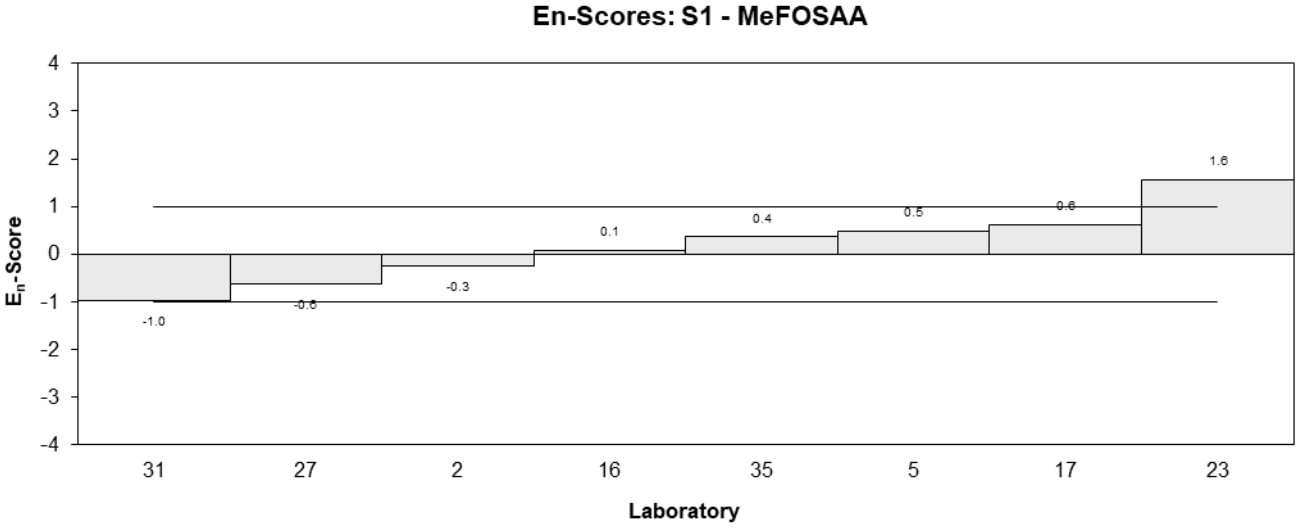

En-Scores: S1 - MeFOSAA
En-Score
-1.0
-0.6
-0.3
0.1
0.4
0.5
0.6
1.6
Laboratory
31 27 2 16 35 5 17 23

Figure 21

Table 25

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFBA |
| **Unit** | µg/kg |

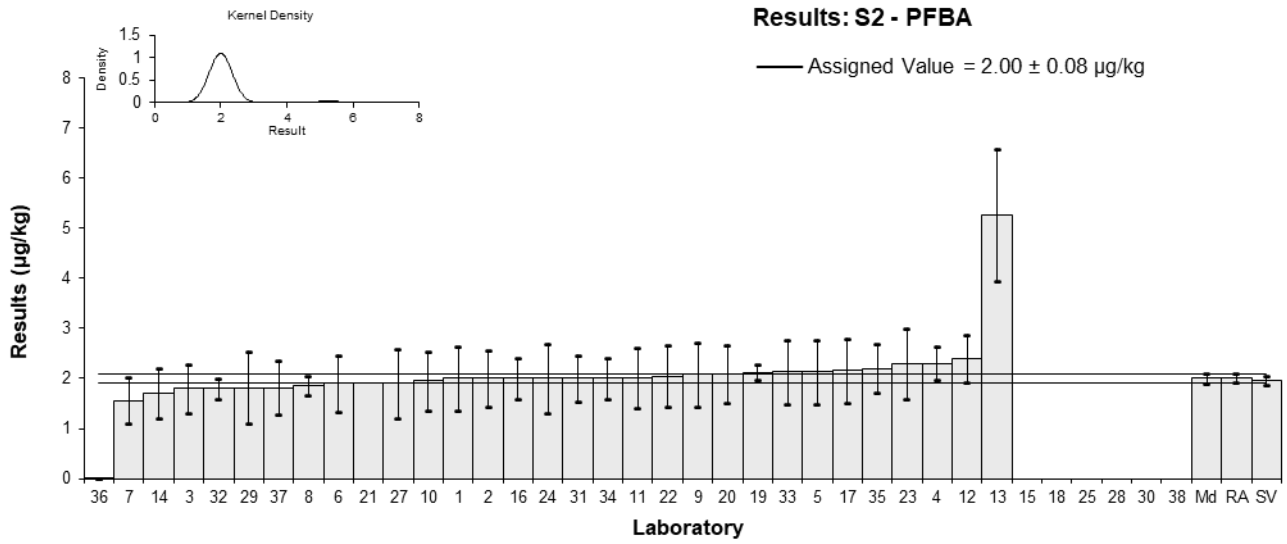
**Participant Results**

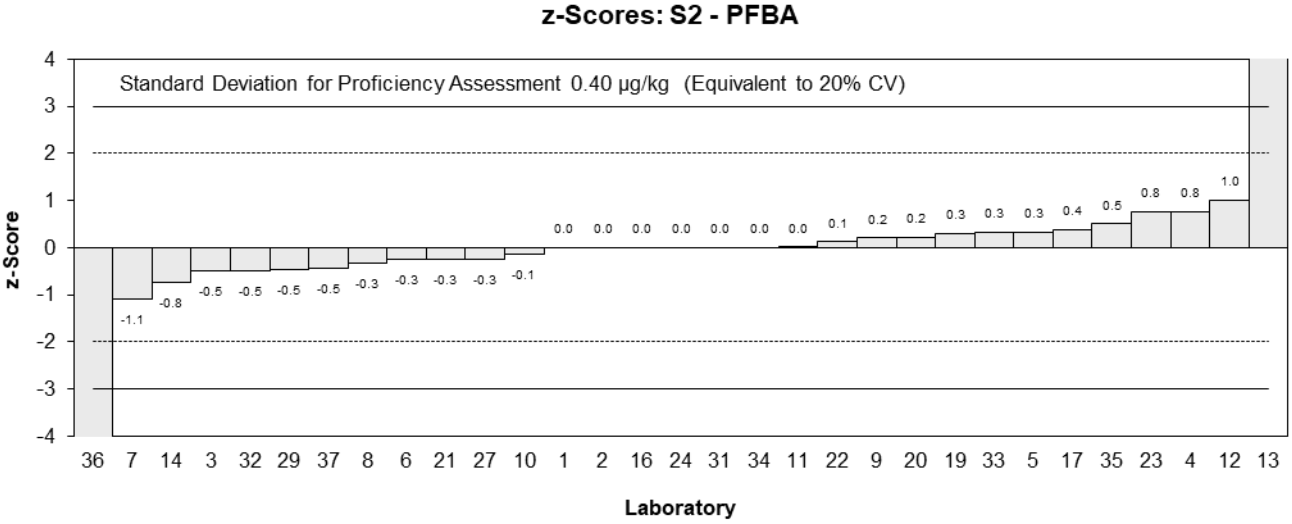
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.0000 | 0.64 | 106 | 0.00 | 0.00 |
| **2** | 2 | 0.56 | NR | 0.00 | 0.00 |
| **3** | 1.799 | 0.495 | NR | -0.50 | -0.40 |
| **4** | 2.3055 | 0.34 | 92 | 0.76 | 0.87 |
| **5** | 2.13219 | 0.639657 | 96 | 0.33 | 0.21 |
| **6** | 1.9 | 0.57 | 87 | -0.25 | -0.17 |
| **7** | 1.56 | 0.46 | NR | -1.10 | -0.94 |
| **8** | 1.862226 | 0.18622 | >75 | -0.34 | -0.68 |
| **9** | 2.08 | 0.64 | 90 | 0.20 | 0.12 |
| **10** | 1.95 | 0.585 | 110 | -0.13 | -0.08 |
| **11** | 2.004 | 0.6012 | 68.8 | 0.01 | 0.01 |
| **12** | 2.4 | 0.48 | 109 | 1.00 | 0.82 |
| **13*** | 5.27 | 1.32 | 83 | 8.17 | 2.47 |
| **14** | 1.7 | 0.5 | 90 | -0.75 | -0.59 |
| **15** | NR | NR | NR | | |
| **16** | 2.0 | 0.4 | NR | 0.00 | 0.00 |
| **17** | 2.157052 | 0.647115 | 100 | 0.39 | 0.24 |
| **18** | <5 | NR | NR | | |
| **19** | 2.12 | 0.153 | 78 | 0.30 | 0.70 |
| **20** | 2.09 | 0.58 | 115 | 0.22 | 0.15 |
| **21** | 1.9 | NR | 98 | -0.25 | -1.25 |
| **22** | 2.05 | 0.614 | 87 | 0.12 | 0.08 |
| **23** | 2.3 | 0.7 | 89 | 0.75 | 0.43 |
| **24** | 2 | 0.7 | 83.85 | 0.00 | 0.00 |
| **25** | <5 | NR | NR | | |
| **27** | 1.9 | 0.684 | NT | -0.25 | -0.15 |
| **28** | < 5 | 2.5 | 101 | | |
| **29** | 1.816 | 0.726 | NR | -0.46 | -0.25 |
| **30** | NS | NS | NS | | |
| **31** | 2 | 0.47 | 71.85 | 0.00 | 0.00 |
| **32** | 1.8 | 0.20 | NR | -0.50 | -0.93 |
| **33** | 2.132 | 0.64 | 62 | 0.33 | 0.20 |
| **34** | 2.0 | 0.4 | 108 | 0.00 | 0.00 |
| **35** | 2.2 | 0.48 | 115.2 | 0.50 | 0.41 |
| **36**** | 0.00193 | 0.00013 | 93 | -5.00 | -24.98 |
| **37** | 1.82 | 0.546 | 82 | -0.45 | -0.33 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 2.00 | 0.08 |
| **Spike Value** | 1.96 | 0.10 |
| **Robust Average** | 2.01 | 0.09 |
| **Median** | 2.00 | 0.09 |
| **Mean** | 2.11 | |
| **N** | 30 | |
| **Max** | 5.27 | |
| **Min** | 1.56 | |
| **Robust SD** | 0.19 | |
| **Robust CV** | 9.6% | |


Kernel Density
Density
Result
Results: S2 - PFBA
Assigned Value = 2.00 ± 0.08 µg/kg
Results (µg/kg)
36 7 14 3 32 29 37 8 6 21 27 10 1 2 16 24 31 34 11 22 9 20 19 33 5 17 35 23 4 12 13 15 18 25 28 30 38 Md RA SV
Laboratory


z-Scores: S2 - PFBA
Standard Deviation for Proficiency Assessment 0.40 µg/kg (Equivalent to 20% CV)
z-Score
36 7 14 3 32 29 37 8 6 21 27 10 1 2 16 24 31 34 11 22 9 20 19 33 5 17 35 23 4 12 13
Laboratory

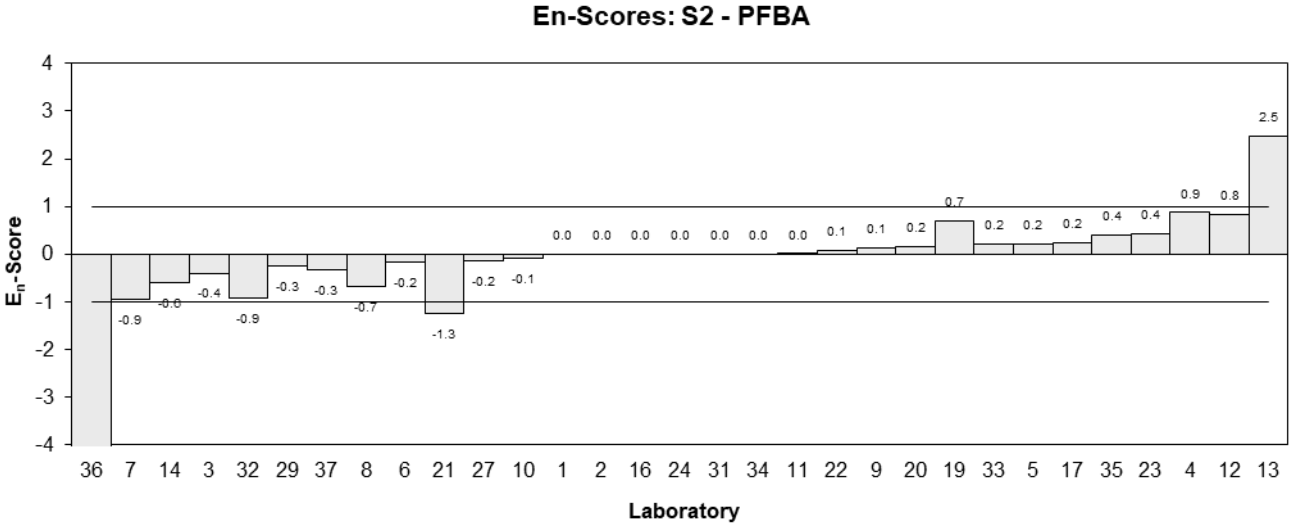

En-Scores: S2 - PFBA
En-Score
36 7 14 3 32 29 37 8 6 21 27 10 1 2 16 24 31 34 11 22 9 20 19 33 5 17 35 23 4 12 13
Laboratory

Figure 22

Table 26

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFPeA |
| **Unit** | µg/kg |

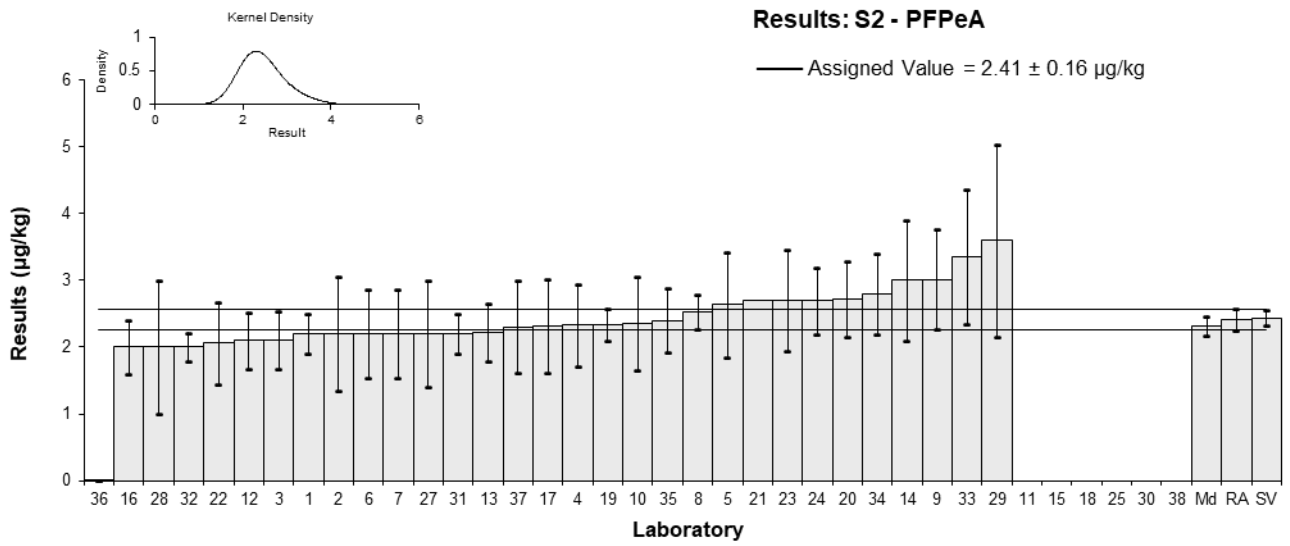
**Participant Results**

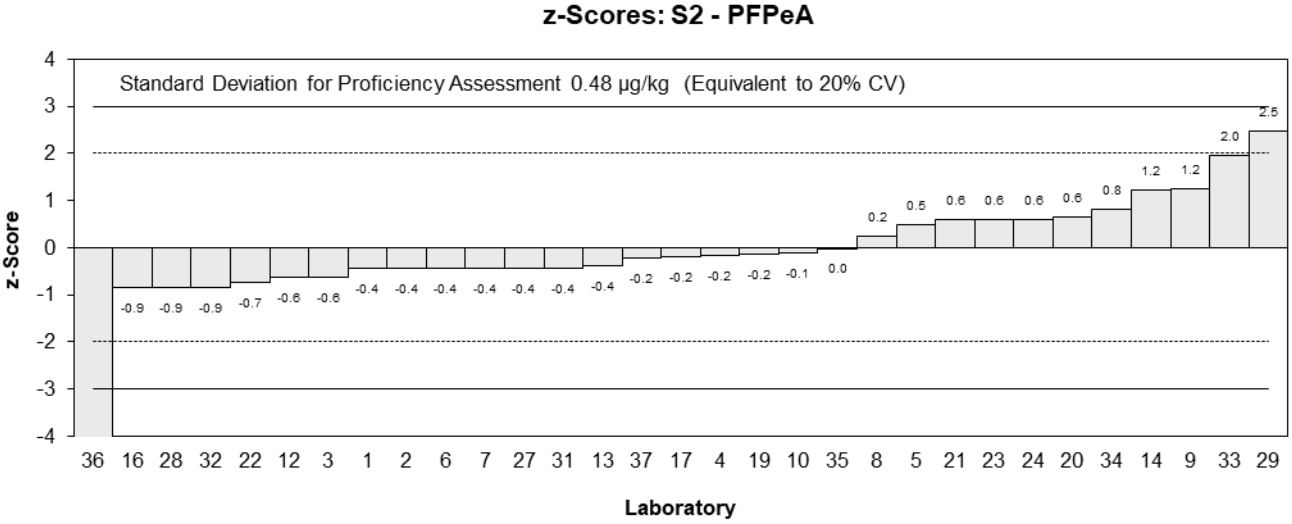
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.2 | 0.30 | 104 | -0.44 | -0.62 |
| **2** | 2.2 | 0.86 | NR | -0.44 | -0.24 |
| **3** | 2.109 | 0.435 | NR | -0.62 | -0.65 |
| **4** | 2.3308 | 0.62 | 89 | -0.16 | -0.12 |
| **5** | 2.63918 | 0.791754 | 79 | 0.48 | 0.28 |
| **6** | 2.2 | 0.66 | 99 | -0.44 | -0.31 |
| **7** | 2.2 | 0.66 | NR | -0.44 | -0.31 |
| **8** | 2.525643 | 0.25256 | >75 | 0.24 | 0.39 |
| **9** | 3.01 | 0.75 | 81 | 1.24 | 0.78 |
| **10** | 2.35 | 0.705 | 105 | -0.12 | -0.08 |
| **11** | NR | NR | NR | | |
| **12** | 2.1 | 0.42 | 123 | -0.64 | -0.69 |
| **13** | 2.22 | 0.44 | 70 | -0.39 | -0.41 |
| **14** | 3 | 0.9 | 61 | 1.22 | 0.65 |
| **15** | NR | NR | NR | | |
| **16** | 2.0 | 0.4 | NR | -0.85 | -0.95 |
| **17** | 2.316359 | 0.694907 | 104 | -0.19 | -0.13 |
| **18** | <5 | NR | NR | | |
| **19** | 2.34 | 0.237 | 79 | -0.15 | -0.24 |
| **20** | 2.72 | 0.56 | 107 | 0.64 | 0.53 |
| **21** | 2.7 | NR | 88 | 0.60 | 1.81 |
| **22** | 2.06 | 0.617 | 99 | -0.73 | -0.55 |
| **23** | 2.7 | 0.76 | 91 | 0.60 | 0.37 |
| **24** | 2.7 | 0.5 | 82.38 | 0.60 | 0.55 |
| **25** | <5 | NR | NR | | |
| **27** | 2.2 | 0.792 | NT | -0.44 | -0.26 |
| **28** | 2 | 1 | 95 | -0.85 | -0.40 |
| **29** | 3.600 | 1.440 | NR | 2.47 | 0.82 |
| **30** | NS | NS | NS | | |
| **31** | 2.2 | 0.29 | 78.93 | -0.44 | -0.63 |
| **32** | 2.0 | 0.22 | NR | -0.85 | -1.51 |
| **33** | 3.352 | 1.01 | 69 | 1.95 | 0.92 |
| **34** | 2.8 | 0.6 | 99 | 0.81 | 0.63 |
| **35** | 2.4 | 0.48 | 108.8 | -0.02 | -0.02 |
| **36**** | 0.00241 | 0.00022 | 95 | -5.00 | -15.05 |
| **37** | 2.3 | 0.69 | 94 | -0.23 | -0.16 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 2.41 | 0.16 |
| **Spike Value** | 2.44 | 0.12 |
| **Robust Average** | 2.41 | 0.16 |
| **Median** | 2.32 | 0.15 |
| **Mean** | 2.45 | |
| **N** | 30 | |
| **Max** | 3.6 | |
| **Min** | 2 | |
| **Robust SD** | 0.36 | |
| **Robust CV** | 15% | |


Kernel Density
Density
Result
Results: S2 - PFPeA
Assigned Value = 2.41 ± 0.16 µg/kg
Results (µg/kg)
36 16 28 32 22 12 3 1 2 6 7 27 31 13 37 17 4 19 10 35 8 5 21 23 24 20 34 14 9 33 29 11 15 18 25 30 38 Md RA SV
Laboratory


z-Scores: S2 - PFPeA
Standard Deviation for Proficiency Assessment 0.48 µg/kg (Equivalent to 20% CV)
z-Score
-0.9 -0.9 -0.9 -0.7 -0.6 -0.6 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.2 -0.2 -0.2 -0.2 -0.1 0.0 0.2 0.5 0.6 0.6 0.6 0.6 0.8 1.2 1.2 2.0 2.5
36 16 28 32 22 12 3 1 2 6 7 27 31 13 37 17 4 19 10 35 8 5 21 23 24 20 34 14 9 33 29
Laboratory

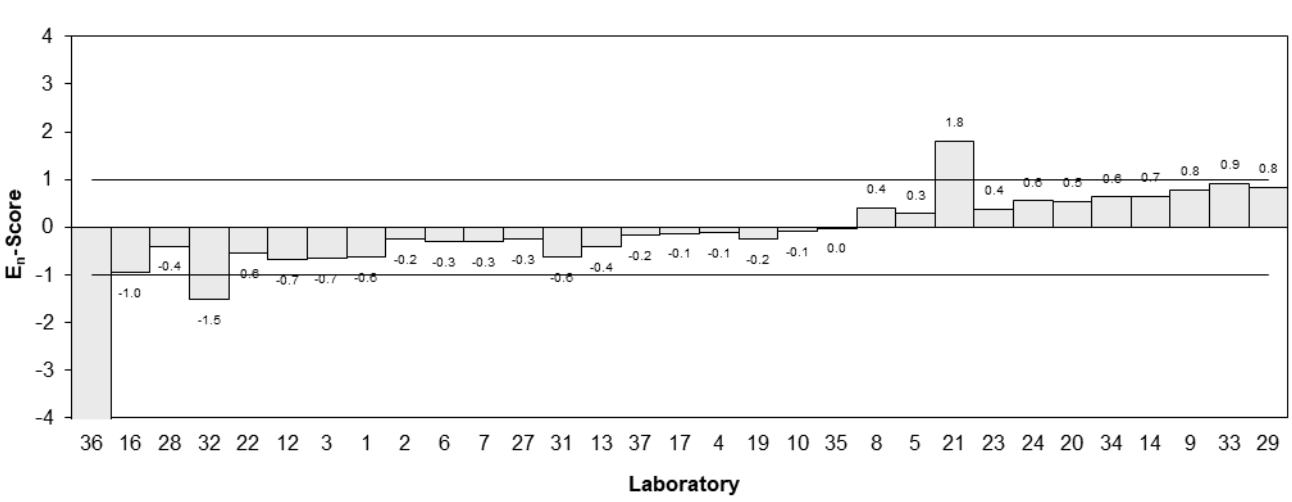

En-Scores: S2 - PFPeA
En-Score
-1.0 -0.4 -1.5 -0.6 -0.7 -0.7 -0.6 -0.2 -0.3 -0.3 -0.3 -0.6 -0.4 -0.2 -0.1 -0.1 -0.2 -0.1 0.0 0.4 0.3 1.8 0.4 0.6 0.5 0.6 0.7 0.8 0.9 0.8
36 16 28 32 22 12 3 1 2 6 7 27 31 13 37 17 4 19 10 35 8 5 21 23 24 20 34 14 9 33 29
Laboratory

Figure 23

Table 27

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFHpA |
| **Unit** | µg/kg |

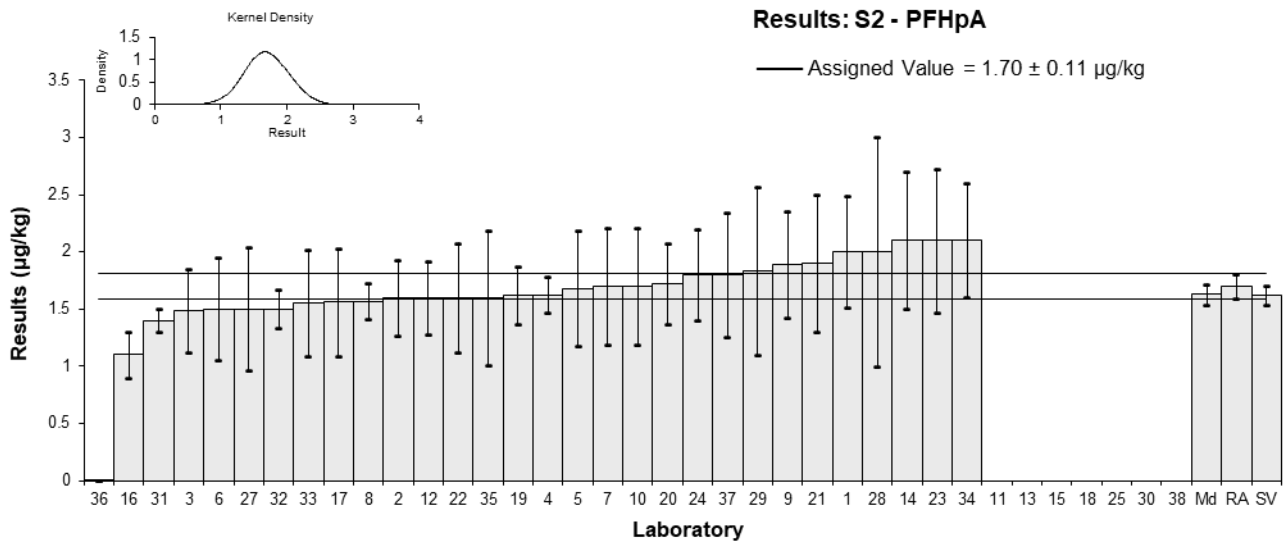
**Participant Results**

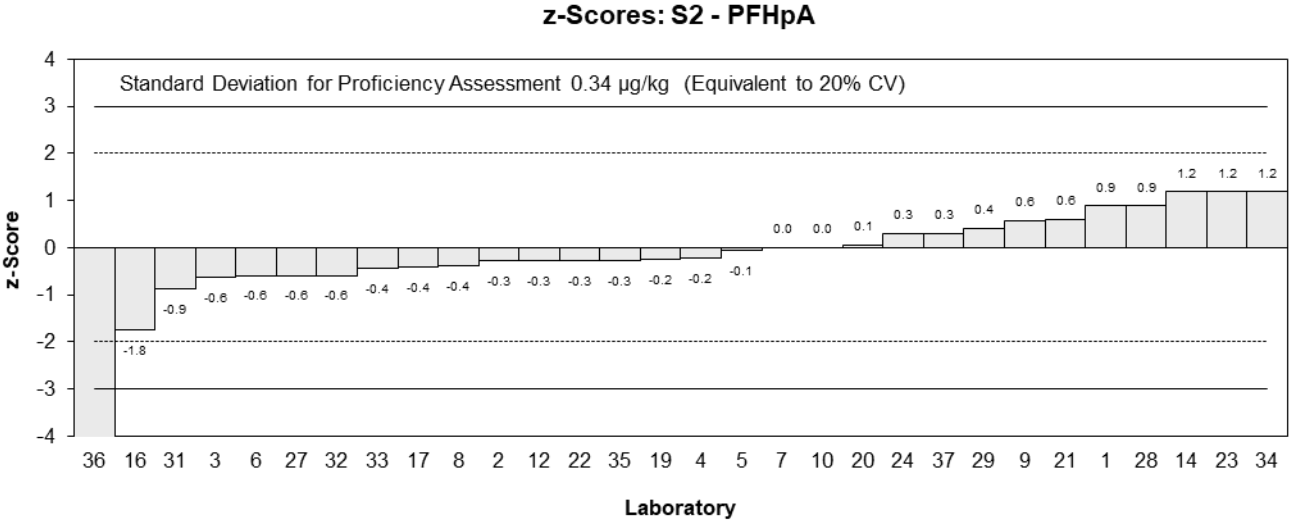
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2 | 0.49 | 101 | 0.88 | 0.60 |
| **2** | 1.6 | 0.33 | NR | -0.29 | -0.29 |
| **3** | 1.483 | 0.363 | NR | -0.64 | -0.57 |
| **4** | 1.626 | 0.16 | 96 | -0.22 | -0.38 |
| **5** | 1.68076 | 0.504228 | 76 | -0.06 | -0.04 |
| **6** | 1.5 | 0.45 | 99 | -0.59 | -0.43 |
| **7** | 1.7 | 0.51 | NR | 0.00 | 0.00 |
| **8** | 1.566409 | 0.15664 | >75 | -0.39 | -0.70 |
| **9** | 1.89 | 0.47 | 92 | 0.56 | 0.39 |
| **10** | 1.7 | 0.51 | 105 | 0.00 | 0.00 |
| **11** | NR | NR | NR | | |
| **12** | 1.6 | 0.32 | 102 | -0.29 | -0.30 |
| **13** | <1 | NR | NR | | |
| **14** | 2.1 | 0.6 | 85 | 1.18 | 0.66 |
| **15** | NR | NR | NR | | |
| **16** | 1.1 | 0.2 | NR | -1.76 | -2.63 |
| **17** | 1.561383 | 0.468415 | 99 | -0.41 | -0.29 |
| **18** | <5 | NR | NR | | |
| **19** | 1.62 | 0.252 | 80 | -0.24 | -0.29 |
| **20** | 1.72 | 0.35 | 107 | 0.06 | 0.05 |
| **21** | 1.9 | 0.6 | 99 | 0.59 | 0.33 |
| **22** | 1.60 | 0.480 | 99 | -0.29 | -0.20 |
| **23** | 2.1 | 0.63 | 94 | 1.18 | 0.63 |
| **24** | 1.8 | 0.4 | 91.17 | 0.29 | 0.24 |
| **25** | <5 | NR | NR | | |
| **27** | 1.5 | 0.54 | NT | -0.59 | -0.36 |
| **28** | 2 | 1 | 97 | 0.88 | 0.30 |
| **29** | 1.837 | 0.735 | NR | 0.40 | 0.18 |
| **30** | NS | NS | NS | | |
| **31** | 1.4 | 0.099 | 77.92 | -0.88 | -2.03 |
| **32** | 1.5 | 0.17 | NR | -0.59 | -0.99 |
| **33** | 1.554 | 0.47 | 90 | -0.43 | -0.30 |
| **34** | 2.1 | 0.5 | 90 | 1.18 | 0.78 |
| **35** | 1.6 | 0.59 | 113.1 | -0.29 | -0.17 |
| **36**** | 0.00168 | 0.00014 | 96 | -5.00 | -15.44 |
| **37** | 1.8 | 0.54 | 112 | 0.29 | 0.18 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.70 | 0.11 |
| **Spike Value** | 1.62 | 0.08 |
| **Robust Average** | 1.70 | 0.11 |
| **Median** | 1.63 | 0.09 |
| **Mean** | 1.69 | |
| **N** | 29 | |
| **Max** | 2.1 | |
| **Min** | 1.1 | |
| **Robust SD** | 0.23 | |
| **Robust CV** | 13% | |


Kernel Density
Density
Result
Results: S2 - PFHpA
Assigned Value = 1.70 ± 0.11 µg/kg
Results (µg/kg)
36 16 31 3 6 27 32 33 17 8 2 12 22 35 19 4 5 7 10 20 24 37 29 9 21 1 28 14 23 34 11 13 15 18 25 30 38 Md RA SV
Laboratory


z-Scores: S2 - PFHpA
Standard Deviation for Proficiency Assessment 0.34 µg/kg (Equivalent to 20% CV)
z-Score
36 16 31 3 6 27 32 33 17 8 2 12 22 35 19 4 5 7 10 20 24 37 29 9 21 1 28 14 23 34
Laboratory

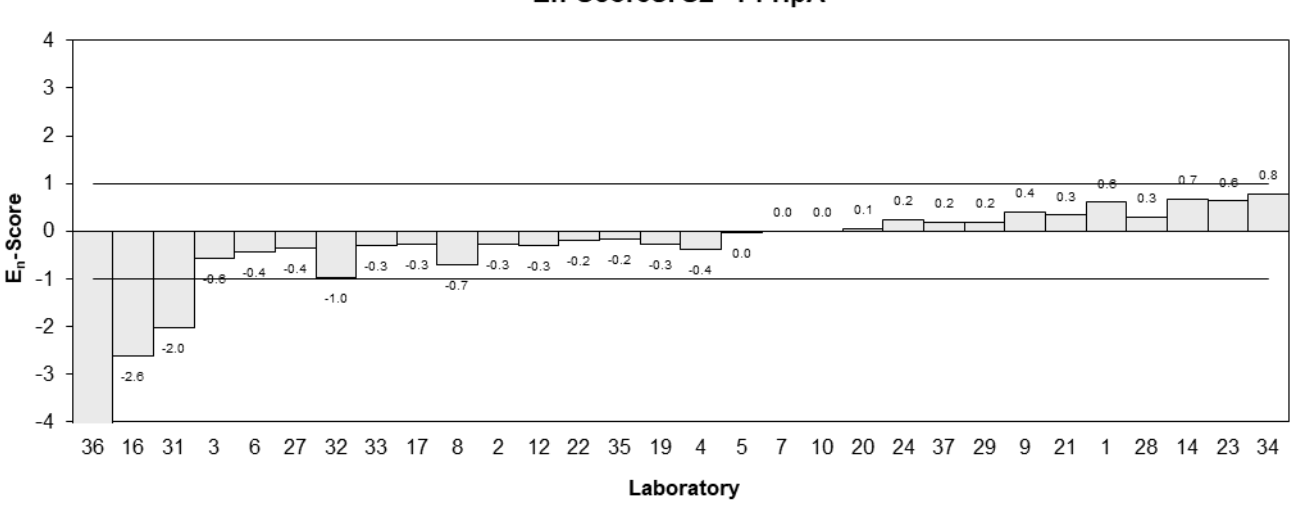

En-Scores: S2 - PFHpA
En-Score
36 16 31 3 6 27 32 33 17 8 2 12 22 35 19 4 5 7 10 20 24 37 29 9 21 1 28 14 23 34
Laboratory

Figure 24

Table 28

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFOA |
| **Unit** | µg/kg |

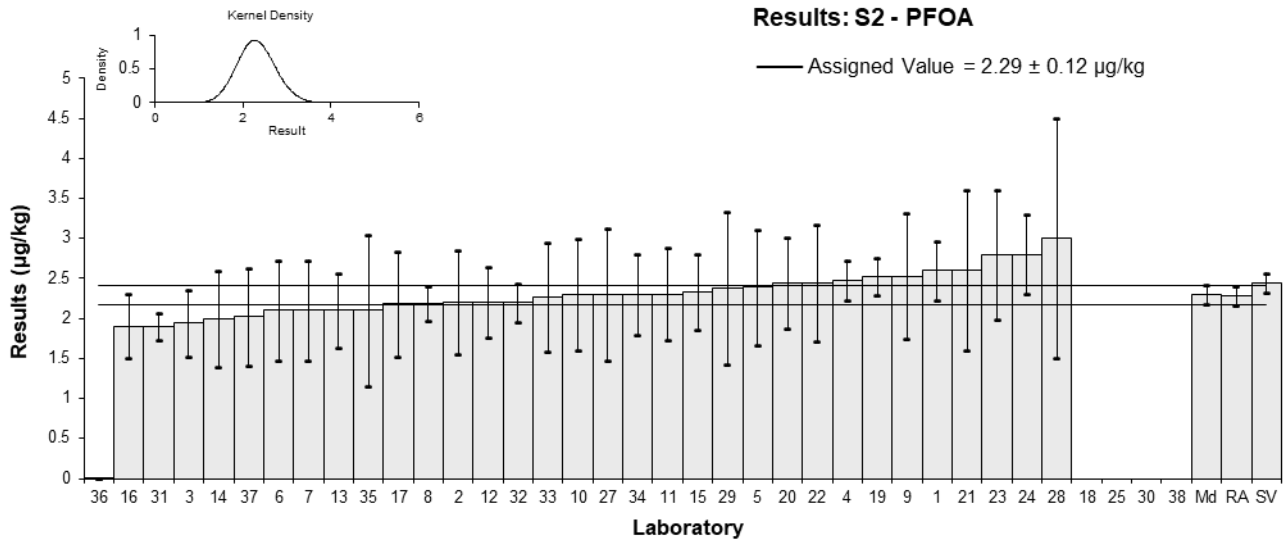
**Participant Results**

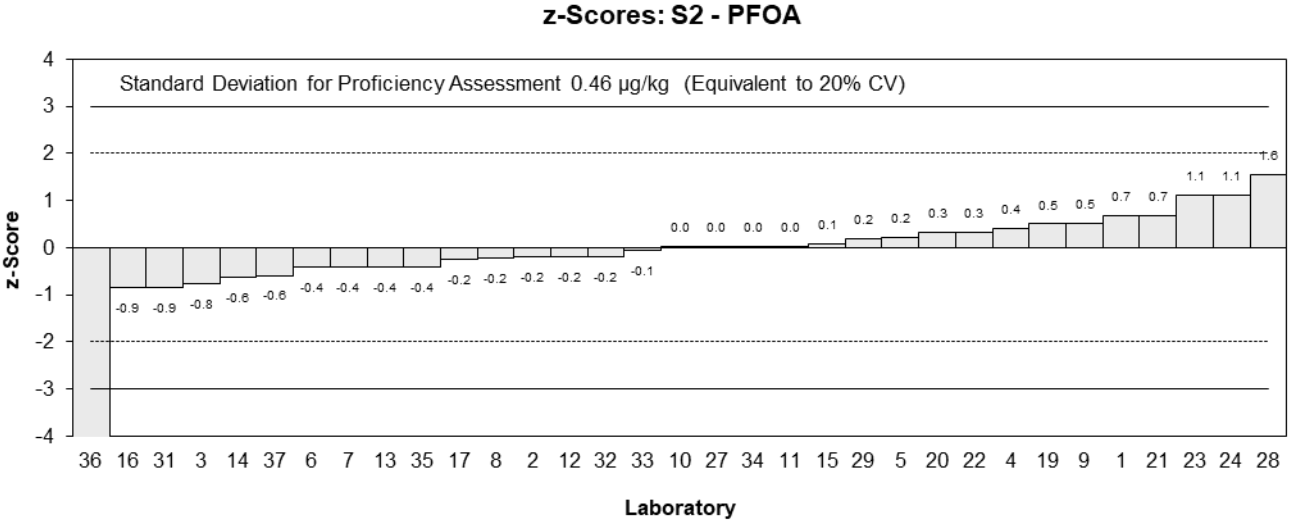
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.6 | 0.37 | 105 | 0.68 | 0.80 |
| **2** | 2.2 | 0.65 | NR | -0.20 | -0.14 |
| **3** | 1.939 | 0.42 | NR | -0.77 | -0.80 |
| **4** | 2.474 | 0.25 | 92 | 0.40 | 0.66 |
| **5** | 2.38862 | 0.716586 | 107 | 0.22 | 0.14 |
| **6** | 2.1 | 0.63 | 101 | -0.41 | -0.30 |
| **7** | 2.1 | 0.63 | NR | -0.41 | -0.30 |
| **8** | 2.190279 | 0.21903 | >75 | -0.22 | -0.40 |
| **9** | 2.53 | 0.78 | 91 | 0.52 | 0.30 |
| **10** | 2.3 | 0.69 | 105 | 0.02 | 0.01 |
| **11** | 2.302 | 0.5755 | 83.7 | 0.03 | 0.02 |
| **12** | 2.2 | 0.44 | 109 | -0.20 | -0.20 |
| **13** | 2.1 | 0.46 | 86 | -0.41 | -0.40 |
| **14** | 2 | 0.6 | 103 | -0.63 | -0.47 |
| **15** | 2.33 | 0.47 | NR | 0.09 | 0.08 |
| **16** | 1.9 | 0.4 | NR | -0.85 | -0.93 |
| **17** | 2.180426 | 0.654127 | 123 | -0.24 | -0.16 |
| **18** | <5 | NR | NR | | |
| **19** | 2.52 | 0.236 | 81 | 0.50 | 0.87 |
| **20** | 2.44 | 0.57 | 115 | 0.33 | 0.26 |
| **21** | 2.6 | 1 | 95 | 0.68 | 0.31 |
| **22** | 2.44 | 0.731 | 101 | 0.33 | 0.20 |
| **23** | 2.8 | 0.81 | 95 | 1.11 | 0.62 |
| **24** | 2.8 | 0.5 | 84.17 | 1.11 | 0.99 |
| **25** | <5 | NR | NR | | |
| **27** | 2.3 | 0.828 | NT | 0.02 | 0.01 |
| **28** | 3 | 1.5 | 100 | 1.55 | 0.47 |
| **29** | 2.377 | 0.951 | NR | 0.19 | 0.09 |
| **30** | NS | NS | NS | | |
| **31** | 1.9 | 0.17 | 98.9 | -0.85 | -1.87 |
| **32** | 2.2 | 0.24 | NR | -0.20 | -0.34 |
| **33** | 2.264 | 0.68 | 95 | -0.06 | -0.04 |
| **34** | 2.3 | 0.5 | 110 | 0.02 | 0.02 |
| **35** | 2.1 | 0.95 | 104.5 | -0.41 | -0.20 |
| **36**** | 0.00251 | 0.00034 | 90 | -4.99 | -19.06 |
| **37** | 2.02 | 0.606 | 99 | -0.59 | -0.44 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 2.29 | 0.12 |
| **Spike Value** | 2.45 | 0.12 |
| **Robust Average** | 2.29 | 0.12 |
| **Median** | 2.30 | 0.12 |
| **Mean** | 2.31 | |
| **N** | 32 | |
| **Max** | 3 | |
| **Min** | 1.9 | |
| **Robust SD** | 0.26 | |
| **Robust CV** | 11% | |


Results: S2 - PFOA
Assigned Value = 2.29 ± 0.12 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
36 16 31 3 14 37 6 7 13 35 17 8 2 12 32 33 10 27 34 11 15 29 5 20 22 4 19 9 1 21 23 24 28 18 25 30 38 Md RA SV
Laboratory


z-Scores: S2 - PFOA
Standard Deviation for Proficiency Assessment 0.46 µg/kg (Equivalent to 20% CV)
z-Score
36 16 31 3 14 37 6 7 13 35 17 8 2 12 32 33 10 27 34 11 15 29 5 20 22 4 19 9 1 21 23 24 28
Laboratory

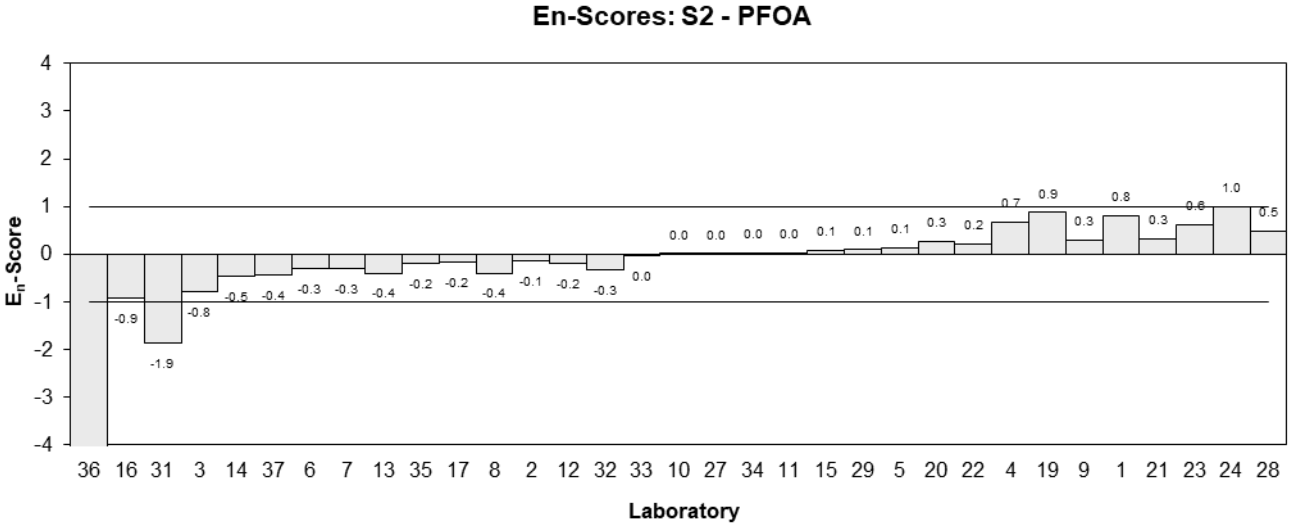

En-Scores: S2 - PFOA
En-Score
36 16 31 3 14 37 6 7 13 35 17 8 2 12 32 33 10 27 34 11 15 29 5 20 22 4 19 9 1 21 23 24 28
Laboratory

Figure 25

Table 29

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFNA |
| **Unit** | µg/kg |

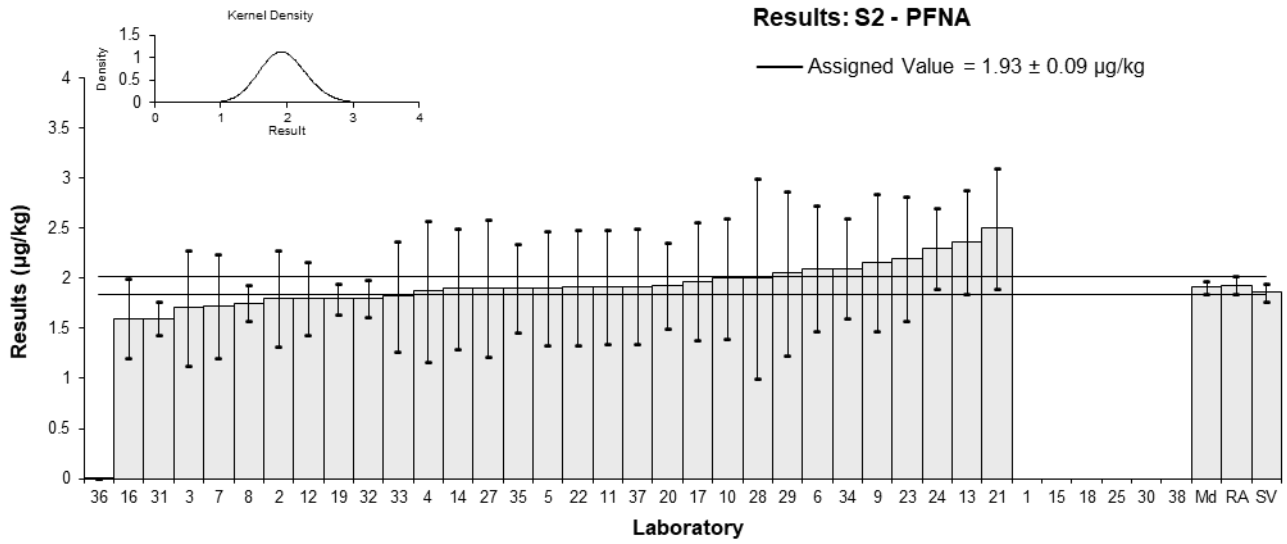
**Participant Results**

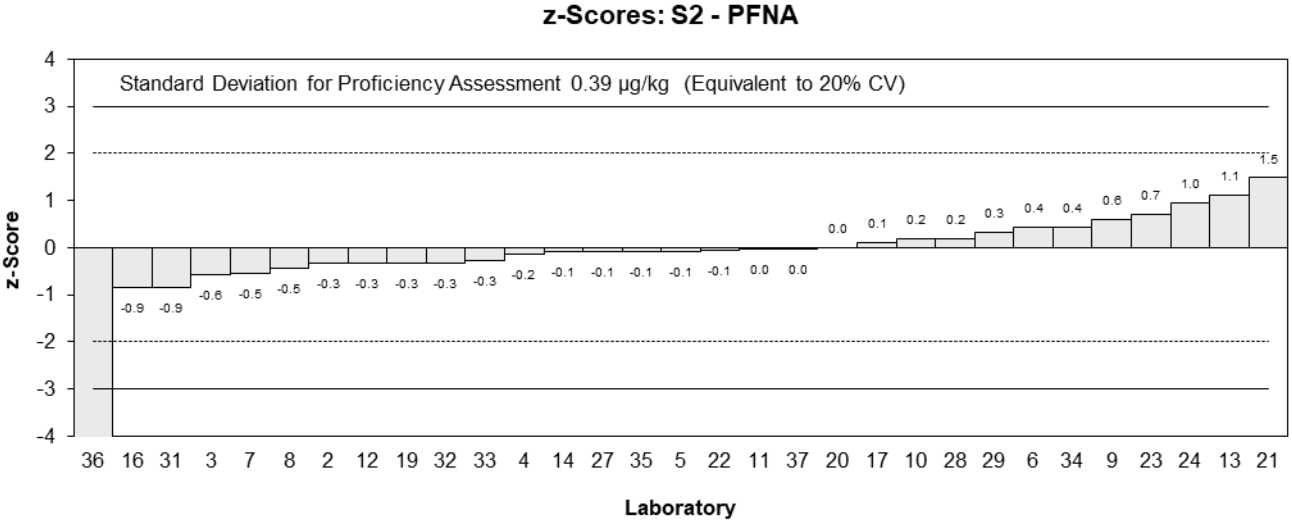
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <5.0 | NR | 103 | | |
| **2** | 1.8 | 0.48 | NR | -0.34 | -0.27 |
| **3** | 1.705 | 0.576 | NR | -0.58 | -0.39 |
| **4** | 1.872 | 0.7 | 92 | -0.15 | -0.08 |
| **5** | 1.90088 | 0.570264 | 108 | -0.08 | -0.05 |
| **6** | 2.1 | 0.63 | 118 | 0.44 | 0.27 |
| **7** | 1.72 | 0.52 | NR | -0.54 | -0.40 |
| **8** | 1.754402 | 0.17544 | >75 | -0.45 | -0.89 |
| **9** | 2.16 | 0.69 | 106 | 0.60 | 0.33 |
| **10** | 2 | 0.6 | 105 | 0.18 | 0.12 |
| **11** | 1.914 | 0.5742 | 91.5 | -0.04 | -0.03 |
| **12** | 1.8 | 0.36 | 109 | -0.34 | -0.35 |
| **13** | 2.36 | 0.52 | 79 | 1.11 | 0.81 |
| **14** | 1.9 | 0.6 | 87 | -0.08 | -0.05 |
| **15** | NR | NR | NR | | |
| **16** | 1.6 | 0.4 | NR | -0.85 | -0.80 |
| **17** | 1.972940 | 0.591882 | 119 | 0.11 | 0.07 |
| **18** | <5 | NR | NR | | |
| **19** | 1.8 | 0.154 | 86 | -0.34 | -0.73 |
| **20** | 1.93 | 0.43 | 118 | 0.00 | 0.00 |
| **21** | 2.5 | 0.6 | 104 | 1.48 | 0.94 |
| **22** | 1.91 | 0.574 | 118 | -0.05 | -0.03 |
| **23** | 2.2 | 0.62 | 99 | 0.70 | 0.43 |
| **24** | 2.3 | 0.4 | 104.43 | 0.96 | 0.90 |
| **25** | <5 | NR | NR | | |
| **27** | 1.9 | 0.684 | NT | -0.08 | -0.04 |
| **28** | 2 | 1 | 121 | 0.18 | 0.07 |
| **29** | 2.054 | 0.822 | NR | 0.32 | 0.15 |
| **30** | NS | NS | NS | | |
| **31** | 1.6 | 0.17 | 98.48 | -0.85 | -1.72 |
| **32** | 1.8 | 0.19 | NR | -0.34 | -0.62 |
| **33** | 1.821 | 0.55 | 100 | -0.28 | -0.20 |
| **34** | 2.1 | 0.5 | 102 | 0.44 | 0.33 |
| **35** | 1.9 | 0.44 | 110.4 | -0.08 | -0.07 |
| **36**** | 0.00190 | 0.00019 | 97 | -5.00 | -21.42 |
| **37** | 1.92 | 0.576 | 102 | -0.03 | -0.02 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.93 | 0.09 |
| **Spike Value** | 1.86 | 0.09 |
| **Robust Average** | 1.93 | 0.09 |
| **Median** | 1.91 | 0.07 |
| **Mean** | 1.94 | |
| **N** | 30 | |
| **Max** | 2.5 | |
| **Min** | 1.6 | |
| **Robust SD** | 0.19 | |
| **Robust CV** | 10% | |


Kernel Density
Density
Result
Results: S2 - PFNA
Assigned Value = 1.93 ± 0.09 µg/kg
Results (µg/kg)
36 16 31 3 7 8 2 12 19 32 33 4 14 27 35 5 22 11 37 20 17 10 28 29 6 34 9 23 24 13 21 1 15 18 25 30 38 Md RA SV
Laboratory


z-Scores: S2 - PFNA
Standard Deviation for Proficiency Assessment 0.39 µg/kg (Equivalent to 20% CV)
z-Score
-0.9 -0.9 -0.6 -0.5 -0.5 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.1 -0.1 -0.1 -0.1 -0.1 0.0 0.0 0.0 0.1 0.2 0.2 0.3 0.4 0.4 0.6 0.7 1.0 1.1 1.5
36 16 31 3 7 8 2 12 19 32 33 4 14 27 35 5 22 11 37 20 17 10 28 29 6 34 9 23 24 13 21
Laboratory

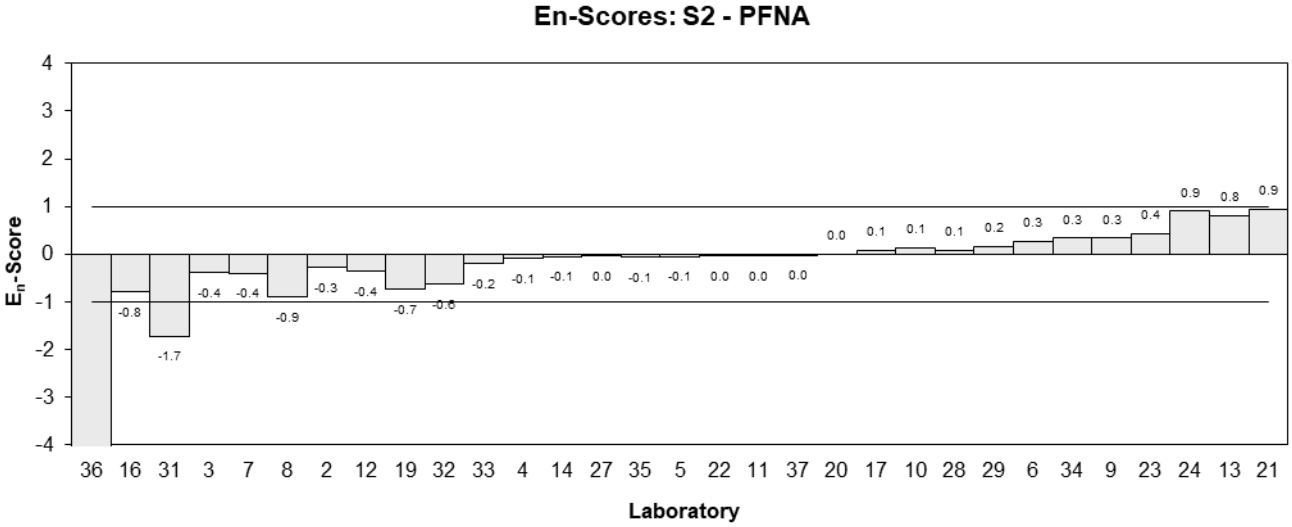

En-Scores: S2 - PFNA
En-Score
-0.8 -1.7 -0.4 -0.4 -0.9 -0.3 -0.4 -0.7 -0.6 -0.2 -0.1 -0.1 0.0 -0.1 -0.1 0.0 0.0 0.0 0.0 0.1 0.1 0.1 0.2 0.3 0.3 0.3 0.4 0.9 0.8 0.9
36 16 31 3 7 8 2 12 19 32 33 4 14 27 35 5 22 11 37 20 17 10 28 29 6 34 9 23 24 13 21
Laboratory

Figure 26

Table 30

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFUdA |
| **Unit** | µg/kg |

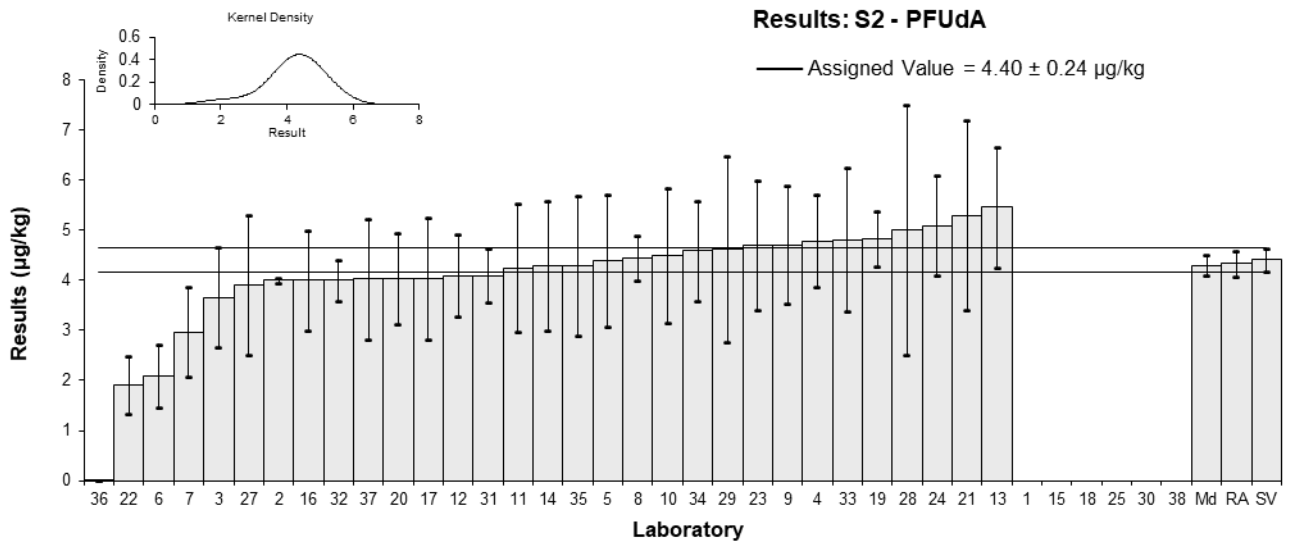
**Participant Results**

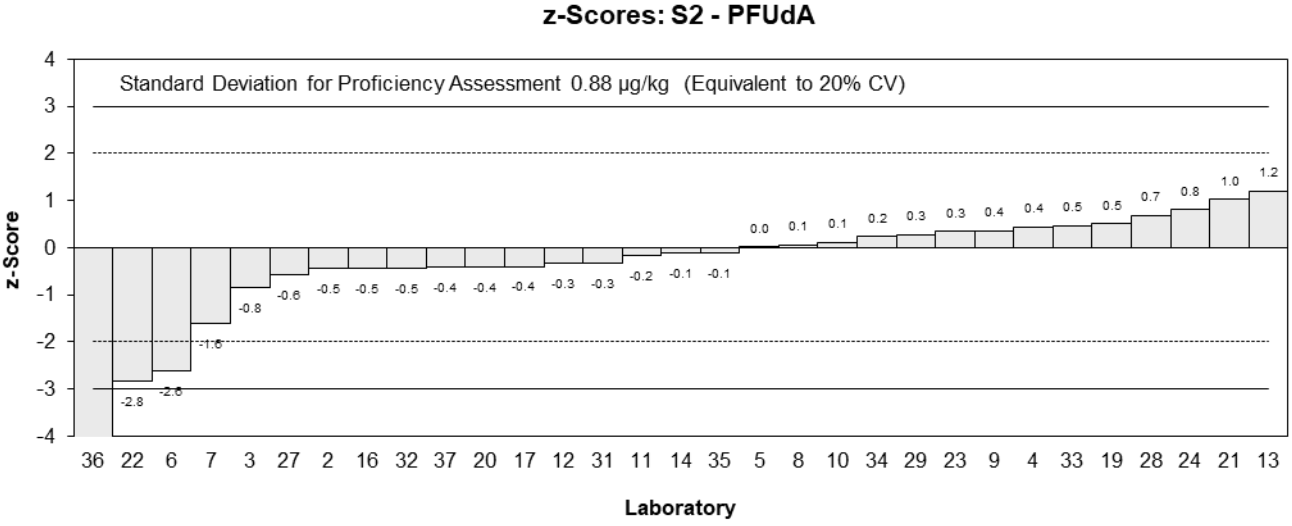
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <5.0 | NR | 108 | | |
| **2** | 4 | 0.04 | NR | -0.45 | -1.64 |
| **3** | 3.663 | 1.002 | NR | -0.84 | -0.72 |
| **4** | 4.788 | 0.93 | 97 | 0.44 | 0.40 |
| **5** | 4.40501 | 1.321503 | 86 | 0.01 | 0.00 |
| **6*** | 2.1 | 0.63 | 85 | -2.61 | -3.41 |
| **7** | 2.97 | 0.9 | NR | -1.62 | -1.54 |
| **8** | 4.439790 | 0.44398 | >75 | 0.05 | 0.08 |
| **9** | 4.71 | 1.18 | 94 | 0.35 | 0.26 |
| **10** | 4.5 | 1.35 | 99 | 0.11 | 0.07 |
| **11** | 4.25 | 1.275 | 82.2 | -0.17 | -0.12 |
| **12** | 4.1 | 0.82 | 120 | -0.34 | -0.35 |
| **13** | 5.46 | 1.2 | 76 | 1.20 | 0.87 |
| **14** | 4.3 | 1.3 | 77 | -0.11 | -0.08 |
| **15** | NR | NR | NR | | |
| **16** | 4.0 | 1 | NR | -0.45 | -0.39 |
| **17** | 4.043732 | 1.213119 | 122 | -0.40 | -0.29 |
| **18** | <5 | NR | NR | | |
| **19** | 4.84 | 0.55 | 64 | 0.50 | 0.73 |
| **20** | 4.04 | 0.91 | 96 | -0.41 | -0.38 |
| **21** | 5.3 | 1.9 | 76 | 1.02 | 0.47 |
| **22*** | 1.91 | 0.573 | 85 | -2.83 | -4.01 |
| **23** | 4.7 | 1.3 | 101 | 0.34 | 0.23 |
| **24** | 5.1 | 1.00 | 94.93 | 0.80 | 0.68 |
| **25** | <5 | NR | NR | | |
| **27** | 3.9 | 1.4 | NT | -0.57 | -0.35 |
| **28** | 5 | 2.5 | 122 | 0.68 | 0.24 |
| **29** | 4.626 | 1.850 | NR | 0.26 | 0.12 |
| **30** | NS | NS | NS | | |
| **31** | 4.1 | 0.53 | 90.62 | -0.34 | -0.52 |
| **32** | 4.0 | 0.42 | NR | -0.45 | -0.83 |
| **33** | 4.816 | 1.44 | 73 | 0.47 | 0.28 |
| **34** | 4.6 | 1 | 79 | 0.23 | 0.19 |
| **35** | 4.3 | 1.4 | 107.5 | -0.11 | -0.07 |
| **36**** | 0.00420 | 0.00056 | 102 | -5.00 | -18.32 |
| **37** | 4.03 | 1.209 | 104 | -0.42 | -0.30 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.40 | 0.24 |
| **Spike Value** | 4.41 | 0.22 |
| **Robust Average** | 4.34 | 0.26 |
| **Median** | 4.30 | 0.21 |
| **Mean** | 4.23 | |
| **N** | 30 | |
| **Max** | 5.46 | |
| **Min** | 1.91 | |
| **Robust SD** | 0.56 | |
| **Robust CV** | 13% | |


Kernel Density
Density
Result
Results: S2 - PFUdA
Assigned Value = 4.40 ± 0.24 µg/kg
Results (µg/kg)
Laboratory
36 22 6 7 3 27 2 16 32 37 20 17 12 31 11 14 35 5 8 10 34 29 23 9 4 33 19 28 24 21 13 1 15 18 25 30 38 Md RA SV


z-Scores: S2 - PFUdA
Standard Deviation for Proficiency Assessment 0.88 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 22 6 7 3 27 2 16 32 37 20 17 12 31 11 14 35 5 8 10 34 29 23 9 4 33 19 28 24 21 13

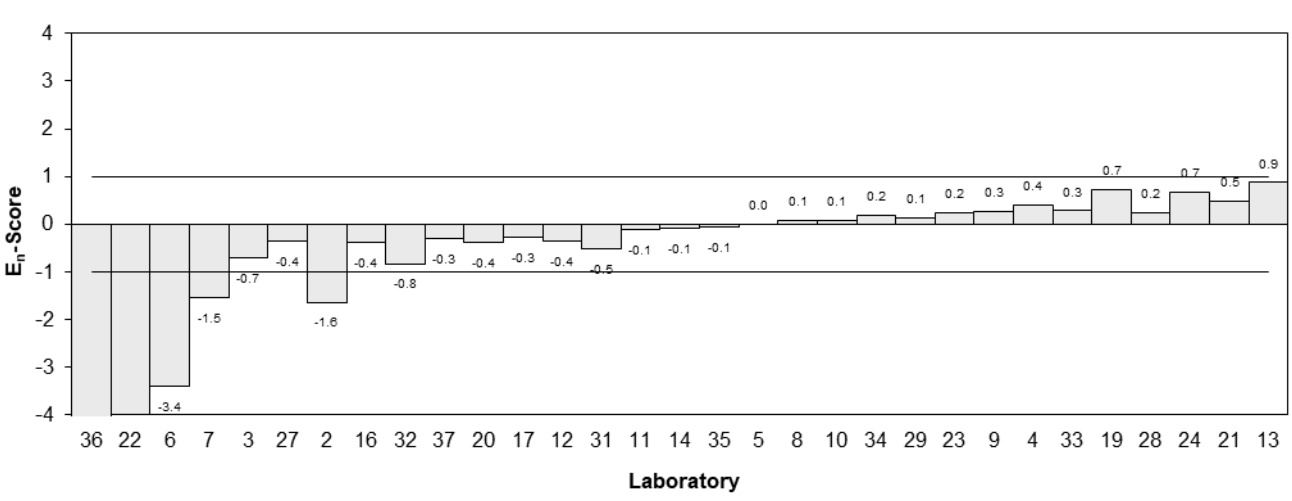

En-Scores: S2 - PFUdA
En-Score
Laboratory
36 22 6 7 3 27 2 16 32 37 20 17 12 31 11 14 35 5 8 10 34 29 23 9 4 33 19 28 24 21 13

Figure 27

Table 31

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFTeDA |
| **Unit** | µg/kg |

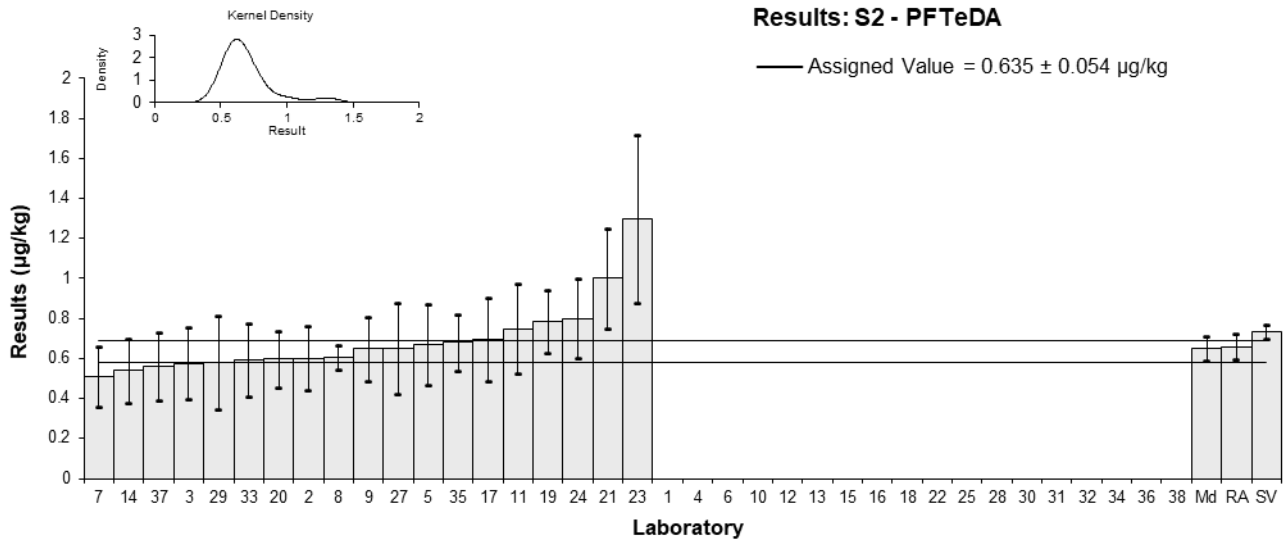
**Participant Results**

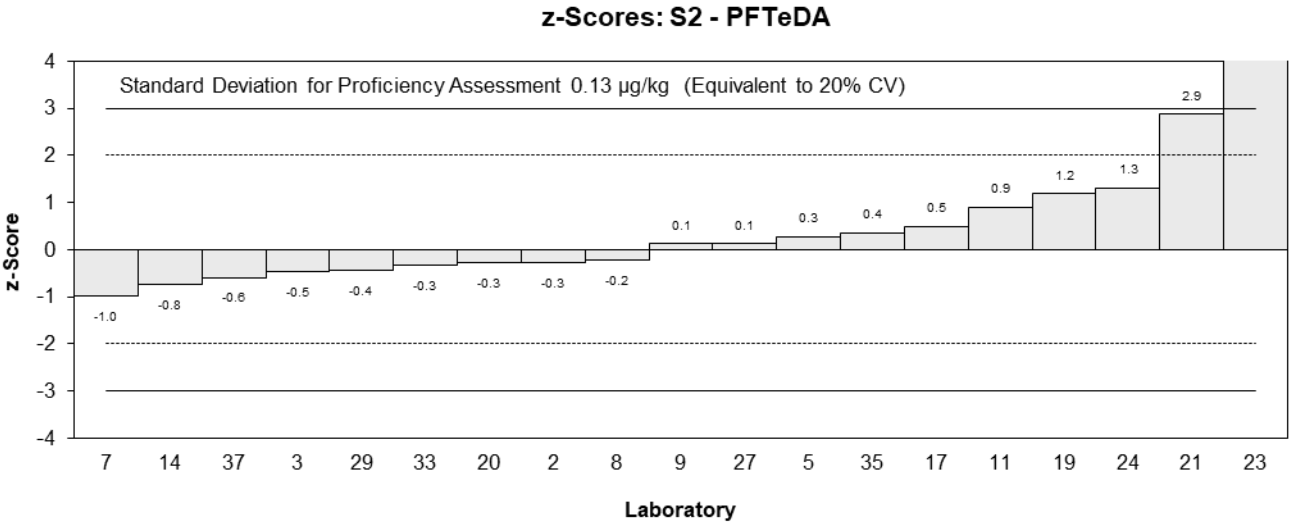
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | 0.6 | 0.16 | NR | -0.28 | -0.21 |
| **3** | 0.576 | 0.178 | NR | -0.46 | -0.32 |
| **4** | <0.5 | 0.5 | 103 | | |
| **5** | 0.67117 | 0.201351 | 101 | 0.28 | 0.17 |
| **6** | <0.001 | NR | NR | | |
| **7** | 0.51 | 0.15 | NR | -0.98 | -0.78 |
| **8** | 0.607367 | 0.06074 | >75 | -0.22 | -0.34 |
| **9** | 0.65 | 0.16 | 103 | 0.12 | 0.09 |
| **10** | <1 | NR | 110 | | |
| **11** | 0.748 | 0.2244 | 91.6 | 0.89 | 0.49 |
| **12** | NR | NR | NR | | |
| **13** | <1 | NR | NR | | |
| **14** | 0.54 | 0.16 | 75 | -0.75 | -0.56 |
| **15** | NR | NR | NR | | |
| **16** | <1 | NR | NR | | |
| **17** | 0.695725 | 0.208717 | 94 | 0.48 | 0.28 |
| **18** | <5 | NR | NR | | |
| **19** | 0.785 | 0.16 | 19 | 1.18 | 0.89 |
| **20** | 0.598 | 0.14 | 108 | -0.29 | -0.25 |
| **21*** | 1 | 0.25 | 127 | 2.87 | 1.43 |
| **22** | <0.001 | NR | NR | | |
| **23*** | 1.3 | 0.42 | 96 | 5.24 | 1.57 |
| **24** | 0.8 | 0.2 | 80.09 | 1.30 | 0.80 |
| **25** | <5 | NR | NR | | |
| **27** | 0.65 | 0.23 | NT | 0.12 | 0.06 |
| **28** | < 10 | 5 | 149 | | |
| **29** | 0.580 | 0.232 | NR | -0.43 | -0.23 |
| **30** | NS | NS | NS | | |
| **31** | <0.5 | NR | 105.09 | | |
| **32** | <1 | NR | NR | | |
| **33** | 0.593 | 0.18 | 59 | -0.33 | -0.22 |
| **34** | <5 | NR | 140 | | |
| **35** | 0.68 | 0.14 | 112.2 | 0.35 | 0.30 |
| **36** | < 0.0010 | 0.00016 | 102 | | |
| **37** | 0.56 | 0.168 | 104 | -0.59 | -0.43 |
| **38** | NS | NS | NS | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 0.635 | 0.054 |
| **Spike Value** | 0.735 | 0.037 |
| **Robust Average** | 0.657 | 0.064 |
| **Median** | 0.650 | 0.060 |
| **Mean** | 0.692 | |
| **N** | 19 | |
| **Max** | 1.3 | |
| **Min** | 0.51 | |
| **Robust SD** | 0.11 | |
| **Robust CV** | 17% | |


Results: S2 - PFTeDA
Assigned Value = 0.635 ± 0.054 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
7 14 37 3 29 33 20 2 8 9 27 5 35 17 11 19 24 21 23 1 4 6 10 12 13 15 16 18 22 25 28 30 31 32 34 36 38 Md RA SV


z-Scores: S2 - PFTeDA
Standard Deviation for Proficiency Assessment 0.13 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
7 14 37 3 29 33 20 2 8 9 27 5 35 17 11 19 24 21 23
-1.0 -0.8 -0.6 -0.5 -0.4 -0.3 -0.3 -0.3 -0.2 0.1 0.1 0.3 0.4 0.5 0.9 1.2 1.3 2.9

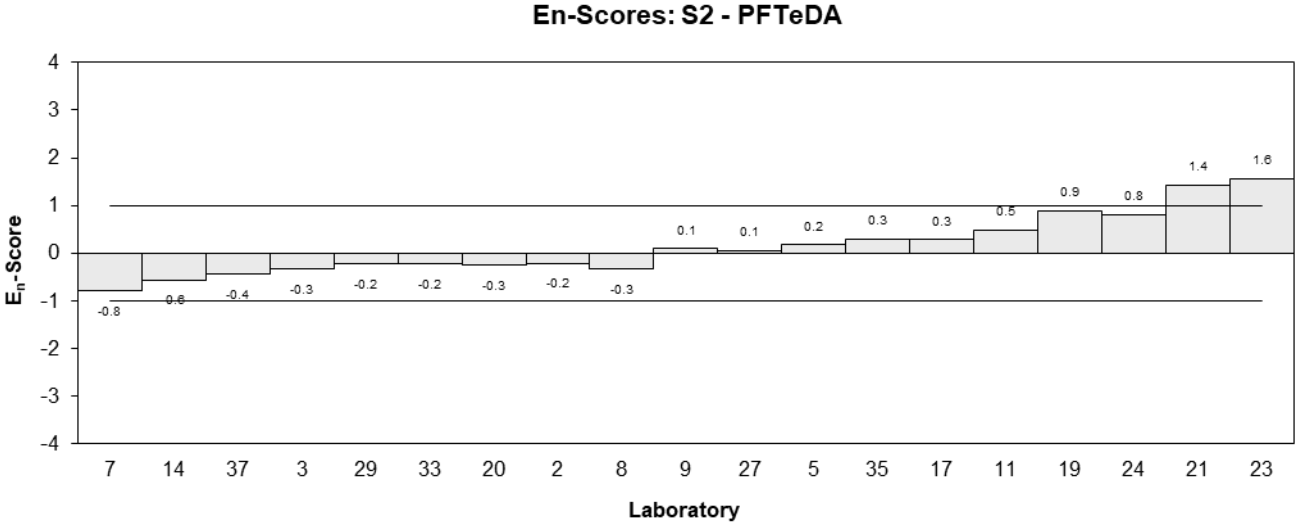

En-Scores: S2 - PFTeDA
En-Score
Laboratory
7 14 37 3 29 33 20 2 8 9 27 5 35 17 11 19 24 21 23
-0.8 -0.6 -0.4 -0.3 -0.2 -0.2 -0.3 -0.2 -0.3 0.1 0.1 0.2 0.3 0.3 0.5 0.9 0.8 1.4 1.6

Figure 28

Table 32

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFHxDA |
| **Unit** | µg/kg |

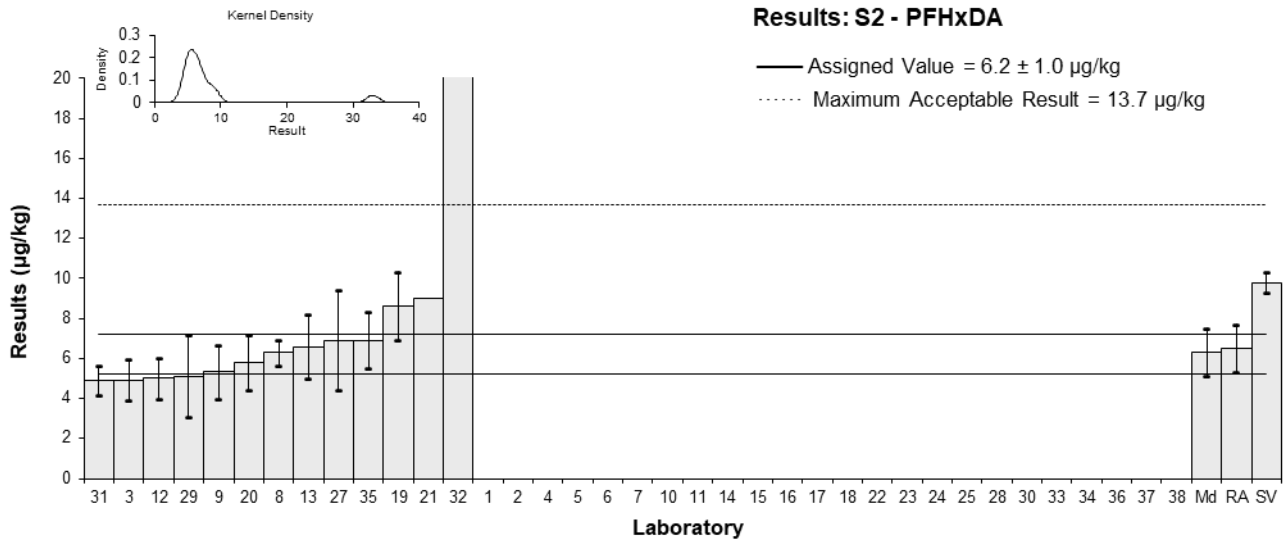
**Participant Results**

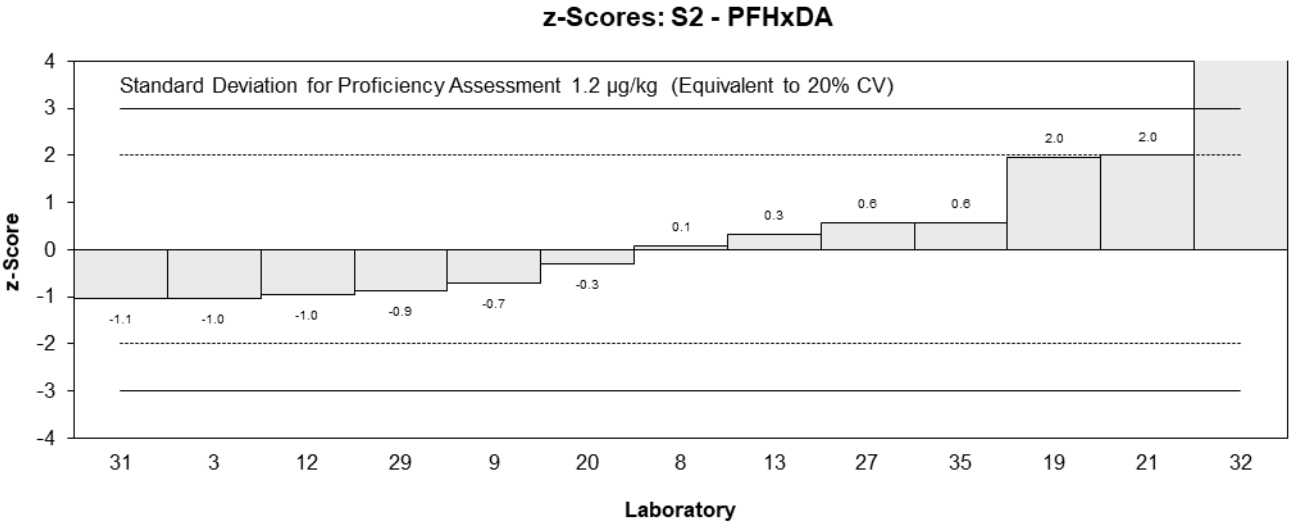
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NT | NT | NT | | |
| **2** | NT | NT | NT | | |
| **3** | 4.922 | 1.035 | NR | -1.03 | -0.89 |
| **4** | NT | NT | NT | | |
| **5** | NT | NT | NT | | |
| **6** | <0.001 | NR | NR | | |
| **7** | NT | NT | NT | | |
| **8** | 6.286888 | 0.62869 | >75 | 0.07 | 0.07 |
| **9** | 5.32 | 1.33 | 84 | -0.71 | -0.53 |
| **10** | NT | NT | NT | | |
| **11** | NR | NR | NR | | |
| **12** | 5.0 | 1.0 | 126 | -0.97 | -0.85 |
| **13** | 6.6 | 1.58 | 69 | 0.32 | 0.21 |
| **14** | NT | NT | NT | | |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 8.63 | 1.71 | 20 | 1.96 | 1.23 |
| **20** | 5.82 | 1.38 | 91 | -0.31 | -0.22 |
| **21** | 9 | NR | 124 | 2.00▼ | |
| **22** | <0.001 | NR | NR | | |
| **23** | NT | NT | NT | | |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 6.9 | 2.5 | NT | 0.56 | 0.26 |
| **28** | NT | NT | NT | | |
| **29** | 5.122 | 2.049 | NR | -0.87 | -0.47 |
| **30** | NS | NS | NS | | |
| **31** | 4.9 | 0.72 | 78.91 | -1.05 | -1.05 |
| **32*** | 33 | 3.5 | NR | 21.61 | 7.36 |
| **33** | NT | NT | NT | | |
| **34** | NT | NT | NT | | |
| **35** | 6.9 | 1.4 | 103.2 | 0.56 | 0.41 |
| **36** | NT | NT | NT | | |
| **37** | NT | NT | NT | | |
| **38** | NS | NS | NS | | |

* Outlier, see Section 4.2; ▼ Adjusted Score, see Section 6.3

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 6.2 | 1.0 |
| **Spike Value** | 9.80 | 0.49 |
| **Robust Average** | 6.5 | 1.2 |
| **Max Acceptable Result** | 13.7 | |
| **Median** | 6.3 | 1.2 |
| **Mean** | 8.3 | |
| **N** | 13 | |
| **Max** | 33 | |
| **Min** | 4.9 | |
| **Robust SD** | 1.8 | |
| **Robust CV** | 27% | |


Results: S2 - PFHxDA
Assigned Value = 6.2 ± 1.0 µg/kg
Maximum Acceptable Result = 13.7 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
31 3 12 29 9 20 8 13 27 35 19 21 32 1 2 4 5 6 7 10 11 14 15 16 17 18 22 23 24 25 28 30 33 34 36 37 38 Md RA SV


z-Scores: S2 - PFHxDA
Standard Deviation for Proficiency Assessment 1.2 µg/kg (Equivalent to 20% CV)
z-Score
-1.1 -1.0 -1.0 -0.9 -0.7 -0.3 0.1 0.3 0.6 0.6 2.0 2.0
Laboratory
31 3 12 29 9 20 8 13 27 35 19 21 32

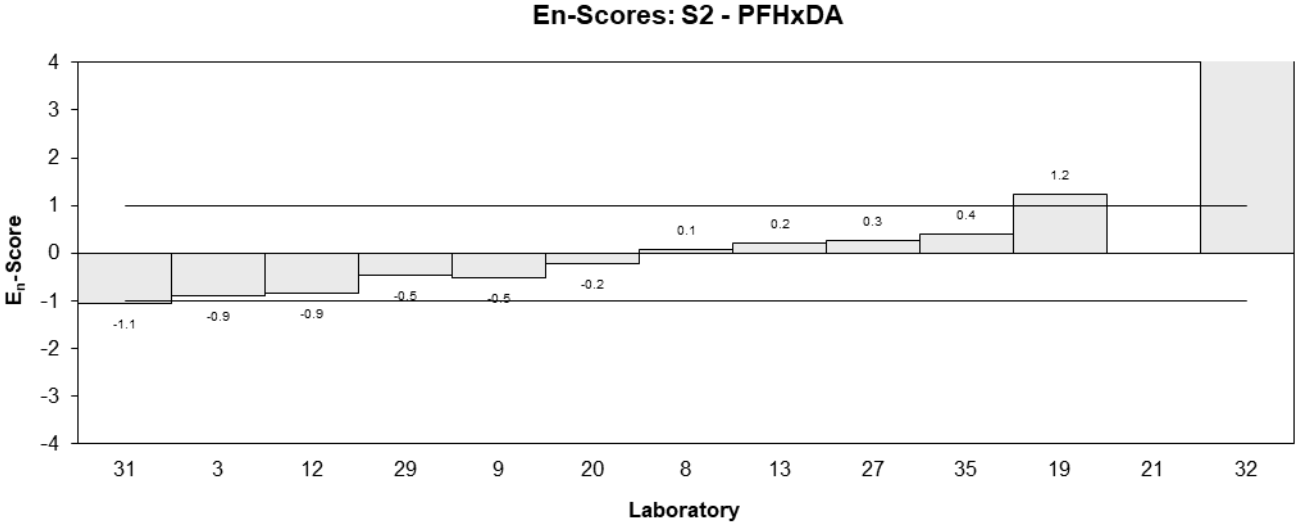

En-Scores: S2 - PFHxDA
En-Score
-1.1 -0.9 -0.9 -0.5 -0.5 -0.2 0.1 0.2 0.3 0.4 1.2
Laboratory
31 3 12 29 9 20 8 13 27 35 19 21 32

Figure 29

Table 33

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFODA |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NT | NT | NT |
| **3** | 2.276 | 0.572 | NR |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | <0.001 | NR | NR |
| **7** | NT | NT | NT |
| **8** | 2.383064 | 0.23831 | >75 |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | NR | NR | NR |
| **12** | NR | NR | NR |
| **13** | 4.22 | 1.14 | NR |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | NT | NT | NT |
| **20** | NT | NT | NT |
| **21** | 13 | NR | NR |
| **22** | <0.001 | NR | NR |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 3.3 | NT | NT |
| **28** | NT | NT | NT |
| **29** | 2.181 | 0.872 | NR |
| **30** | NS | NS | NS |
| **31** | NR | NR | NR |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | <0.07 | NR | 103.2 |
| **36** | NT | NT | NT |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 5.36 | 0.27 |
| **Robust Average** | 3.3 | 1.6 |
| **Median** | 2.84 | 0.93 |
| **Mean** | 4.6 | |
| **N** | 6 | |
| **Max** | 13 | |
| **Min** | 2.181 | |
| **Robust SD** | 1.6 | |
| **Robust CV** | 48% | |

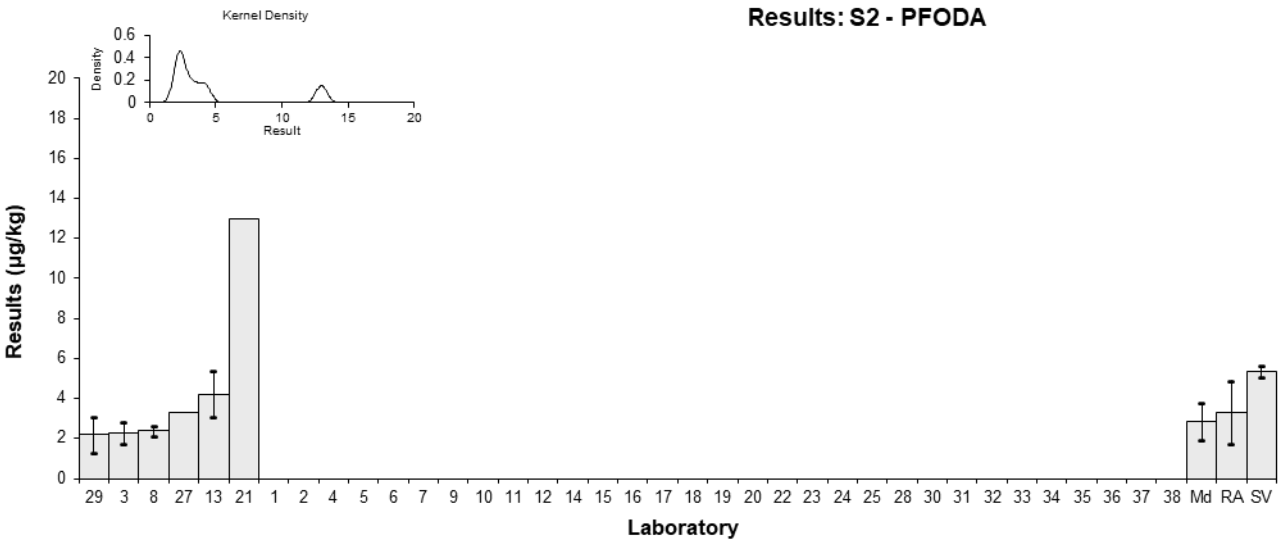

Results: S2 - PFODA
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
29 3 8 27 13 21 1 2 4 5 6 7 9 10 11 12 14 15 16 17 18 19 20 22 23 24 25 28 30 31 32 33 34 35 36 37 38 Md RA SV

Figure 30

Table 34

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFBS |
| **Unit** | µg/kg |

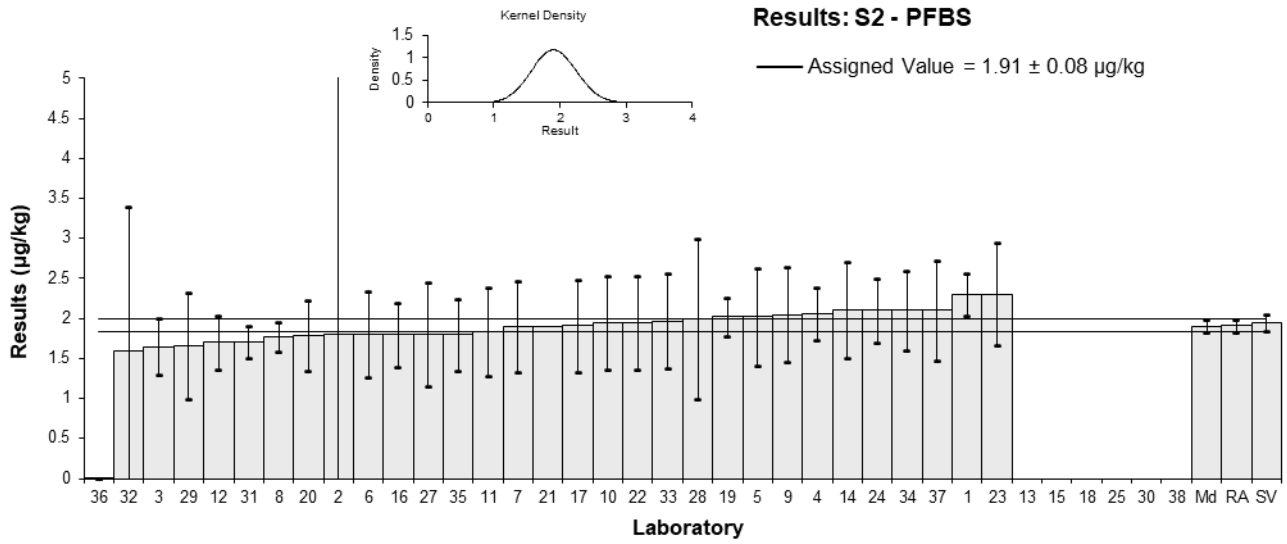
**Participant Results**

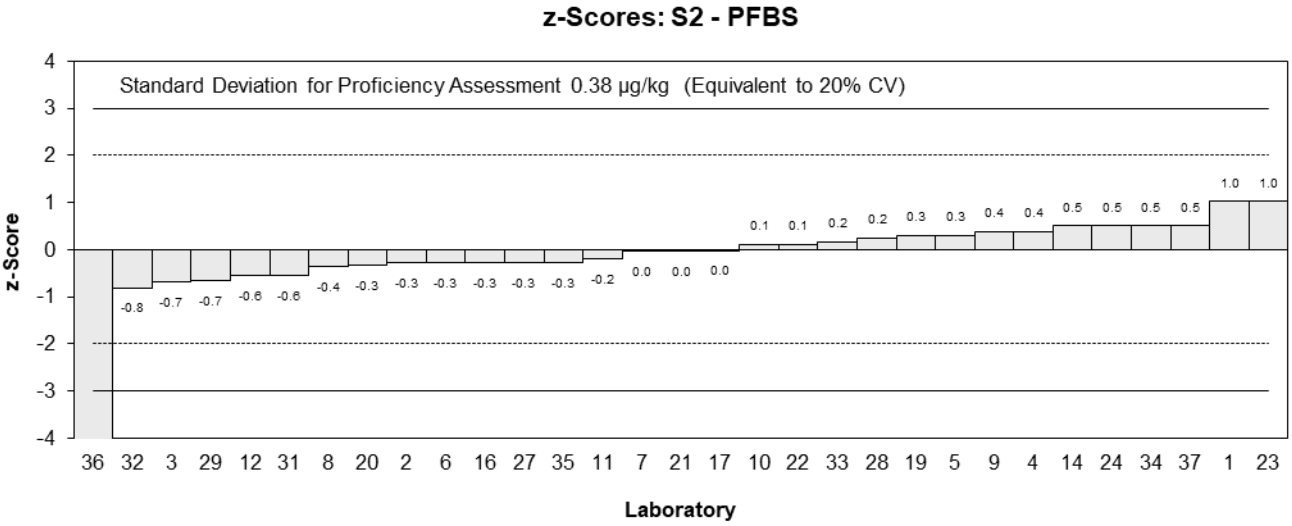
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.3 | 0.26 | 98 | 1.02 | 1.43 |
| **2** | 1.8 | 13.2 | NR | -0.29 | -0.01 |
| **3** | 1.646 | 0.354 | NR | -0.69 | -0.73 |
| **4** | 2.053 | 0.33 | 94 | 0.37 | 0.42 |
| **5** | 2.02052 | 0.606156 | 78.69440 | 0.29 | 0.18 |
| **6** | 1.8 | 0.54 | 99 | -0.29 | -0.20 |
| **7** | 1.9 | 0.57 | NR | -0.03 | -0.02 |
| **8** | 1.770771 | 0.17708 | >75 | -0.36 | -0.72 |
| **9** | 2.05 | 0.59 | 87 | 0.37 | 0.24 |
| **10** | 1.95 | 0.585 | 110 | 0.10 | 0.07 |
| **11** | 1.834 | 0.5502 | 98.4 | -0.20 | -0.14 |
| **12** | 1.7 | 0.34 | 111 | -0.55 | -0.60 |
| **13** | <1 | NR | NR | | |
| **14** | 2.1 | 0.6 | 102 | 0.50 | 0.31 |
| **15** | NR | NR | NR | | |
| **16** | 1.8 | 0.4 | NR | -0.29 | -0.27 |
| **17** | 1.907470 | 0.572241 | 96.58627 | -0.01 | 0.00 |
| **18** | <5 | NR | NR | | |
| **19** | 2.02 | 0.243 | 86 | 0.29 | 0.43 |
| **20** | 1.78 | 0.44 | 113 | -0.34 | -0.29 |
| **21** | 1.9 | NR | 80 | -0.03 | -0.13 |
| **22** | 1.95 | 0.586 | 99 | 0.10 | 0.07 |
| **23** | 2.3 | 0.64 | 91 | 1.02 | 0.60 |
| **24** | 2.1 | 0.4 | 81.18 | 0.50 | 0.47 |
| **25** | <5 | NR | NR | | |
| **27** | 1.8 | 0.65 | NT | -0.29 | -0.17 |
| **28** | 2 | 1 | 97 | 0.24 | 0.09 |
| **29** | 1.662 | 0.665 | NR | -0.65 | -0.37 |
| **30** | NS | NS | NS | | |
| **31** | 1.7 | 0.2 | 90.94 | -0.55 | -0.97 |
| **32** | 1.6 | 1.8 | NR | -0.81 | -0.17 |
| **33** | 1.969 | 0.59 | 88 | 0.15 | 0.10 |
| **34** | 2.1 | 0.5 | 97 | 0.50 | 0.38 |
| **35** | 1.8 | 0.45 | 100.2 | -0.29 | -0.24 |
| **36**** | 0.00197 | 0.00021 | 91 | -4.99 | -23.85 |
| **37** | 2.1 | 0.63 | 117 | 0.50 | 0.30 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.91 | 0.08 |
| **Spike Value** | 1.95 | 0.10 |
| **Robust Average** | 1.91 | 0.08 |
| **Median** | 1.90 | 0.08 |
| **Mean** | 1.91 | |
| **N** | 30 | |
| **Max** | 2.3 | |
| **Min** | 1.6 | |
| **Robust SD** | 0.19 | |
| **Robust CV** | 9.7% | |


Results: S2 - PFBS
Kernel Density
Density
Result
Assigned Value = 1.91 ± 0.08 µg/kg
Results (µg/kg)
Laboratory
36 32 3 29 12 31 8 20 2 6 16 27 35 11 7 21 17 10 22 33 28 19 5 9 4 14 24 34 37 1 23 13 15 18 25 30 38 Md RA SV


z-Scores: S2 - PFBS
Standard Deviation for Proficiency Assessment 0.38 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 32 3 29 12 31 8 20 2 6 16 27 35 11 7 21 17 10 22 33 28 19 5 9 4 14 24 34 37 1 23

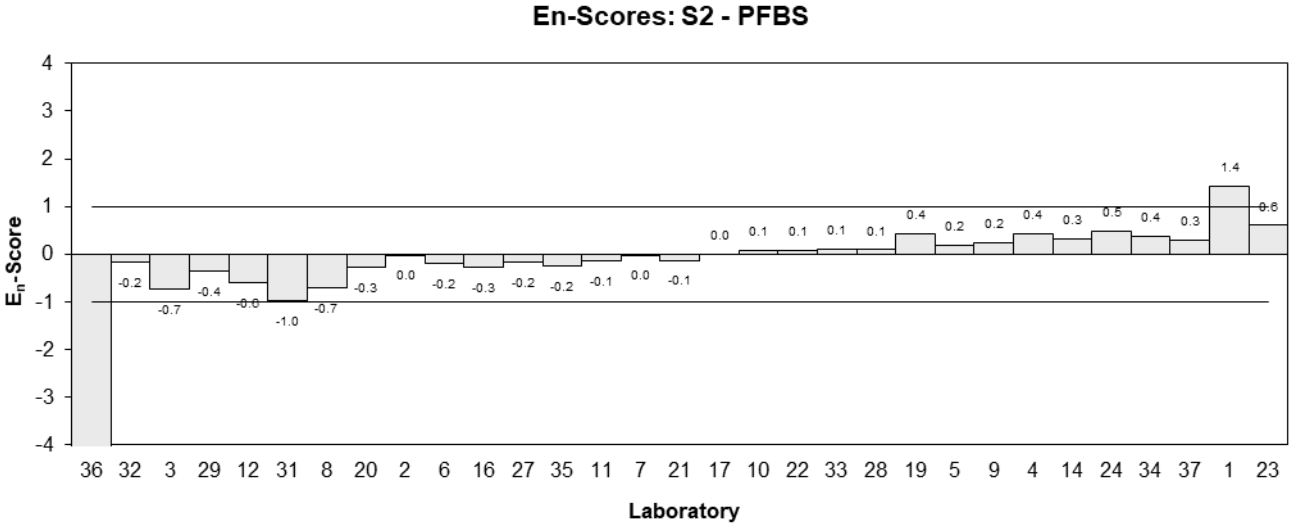

En-Scores: S2 - PFBS
En-Score
Laboratory
36 32 3 29 12 31 8 20 2 6 16 27 35 11 7 21 17 10 22 33 28 19 5 9 4 14 24 34 37 1 23

Figure 31

Table 35

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFHxS |
| **Unit** | µg/kg |

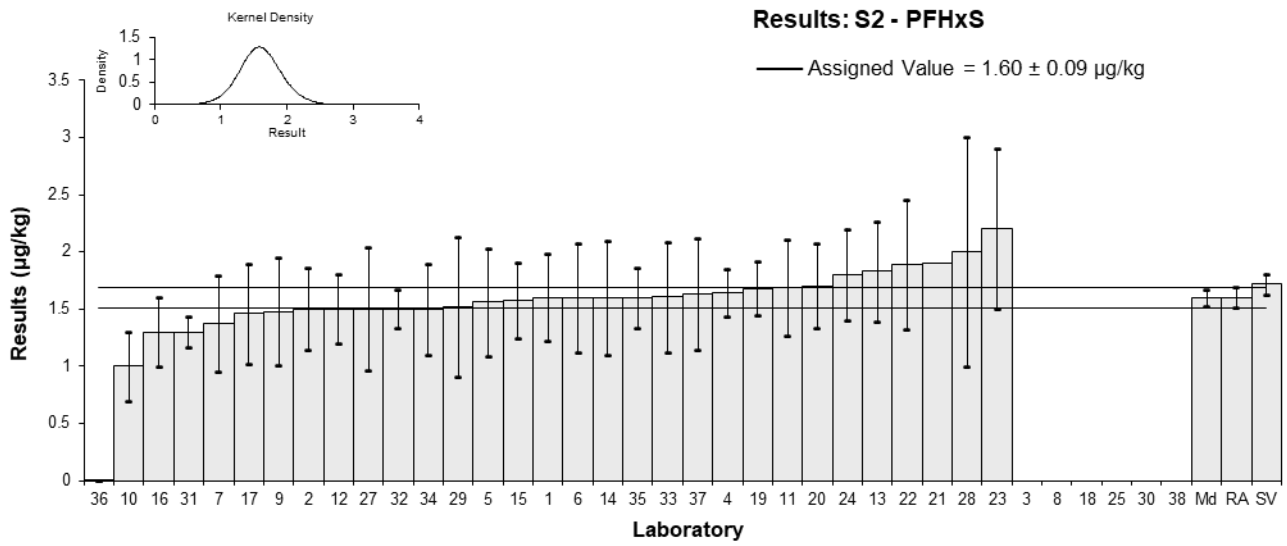
**Participant Results**

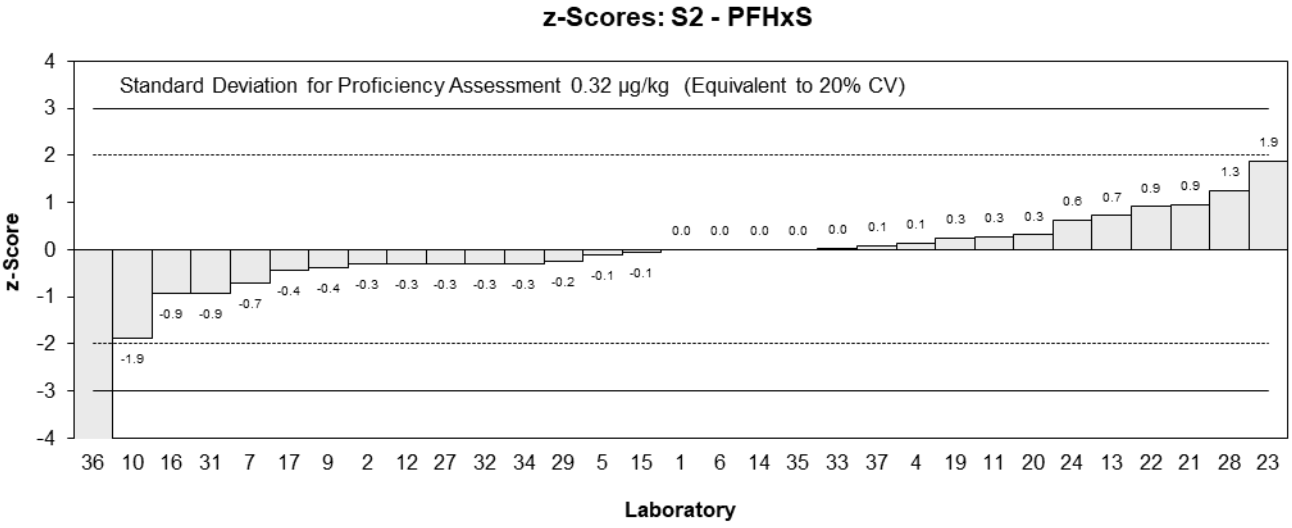
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 1.6 | 0.38 | 98 | 0.00 | 0.00 |
| **2** | 1.5 | 0.36 | NR | -0.31 | -0.27 |
| **3** | NT | NT | NT | | |
| **4** | 1.641 | 0.21 | 84 | 0.13 | 0.18 |
| **5** | 1.56162 | 0.468486 | 115 | -0.12 | -0.08 |
| **6** | 1.6 | 0.48 | 102 | 0.00 | 0.00 |
| **7** | 1.37 | 0.42 | NR | -0.72 | -0.54 |
| **8** | NT | NT | NT | | |
| **9** | 1.48 | 0.47 | 92 | -0.38 | -0.25 |
| **10** | 1 | 0.3 | 105 | -1.88 | -1.92 |
| **11** | 1.684 | 0.421 | 98.8 | 0.26 | 0.20 |
| **12** | 1.5 | 0.30 | 112 | -0.31 | -0.32 |
| **13** | 1.83 | 0.44 | 84 | 0.72 | 0.51 |
| **14** | 1.6 | 0.5 | 84 | 0.00 | 0.00 |
| **15** | 1.58 | 0.33 | NR | -0.06 | -0.06 |
| **16** | 1.3 | 0.3 | NR | -0.94 | -0.96 |
| **17** | 1.459788 | 0.437936 | 124 | -0.44 | -0.31 |
| **18** | <5 | NR | NR | | |
| **19** | 1.68 | 0.235 | 92 | 0.25 | 0.32 |
| **20** | 1.7 | 0.37 | 118 | 0.31 | 0.26 |
| **21** | 1.9 | NR | 89 | 0.94 | 3.33 |
| **22** | 1.89 | 0.567 | 102 | 0.91 | 0.51 |
| **23** | 2.2 | 0.7 | 91 | 1.88 | 0.85 |
| **24** | 1.8 | 0.4 | 78.13 | 0.62 | 0.49 |
| **25** | <5 | NR | NR | | |
| **27** | 1.5 | 0.54 | NT | -0.31 | -0.18 |
| **28** | 2 | 1 | 98 | 1.25 | 0.40 |
| **29** | 1.523 | 0.609 | NR | -0.24 | -0.13 |
| **30** | NS | NS | NS | | |
| **31** | 1.3 | 0.13 | 91.53 | -0.94 | -1.90 |
| **32** | 1.5 | 0.17 | NR | -0.31 | -0.52 |
| **33** | 1.607 | 0.48 | 99 | 0.02 | 0.01 |
| **34** | 1.5 | 0.4 | 104 | -0.31 | -0.24 |
| **35** | 1.6 | 0.26 | 101.2 | 0.00 | 0.00 |
| **36**** | 0.00156 | 0.00012 | 94 | -5.00 | -17.76 |
| **37** | 1.63 | 0.489 | 91 | 0.09 | 0.06 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.60 | 0.09 |
| **Spike Value** | 1.72 | 0.09 |
| **Robust Average** | 1.60 | 0.09 |
| **Median** | 1.60 | 0.07 |
| **Mean** | 1.60 | |
| **N** | 30 | |
| **Max** | 2.2 | |
| **Min** | 1 | |
| **Robust SD** | 0.2 | |
| **Robust CV** | 12% | |


Kernel Density
Density
Result
Results: S2 - PFHxS
Assigned Value = 1.60 ± 0.09 µg/kg
Results (µg/kg)
Laboratory
36 10 16 31 7 17 9 2 12 27 32 34 29 5 15 1 6 14 35 33 37 4 19 11 20 24 13 22 21 28 23 3 8 18 25 30 38 Md RA SV


z-Scores: S2 - PFHxS
Standard Deviation for Proficiency Assessment 0.32 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 10 16 31 7 17 9 2 12 27 32 34 29 5 15 1 6 14 35 33 37 4 19 11 20 24 13 22 21 28 23

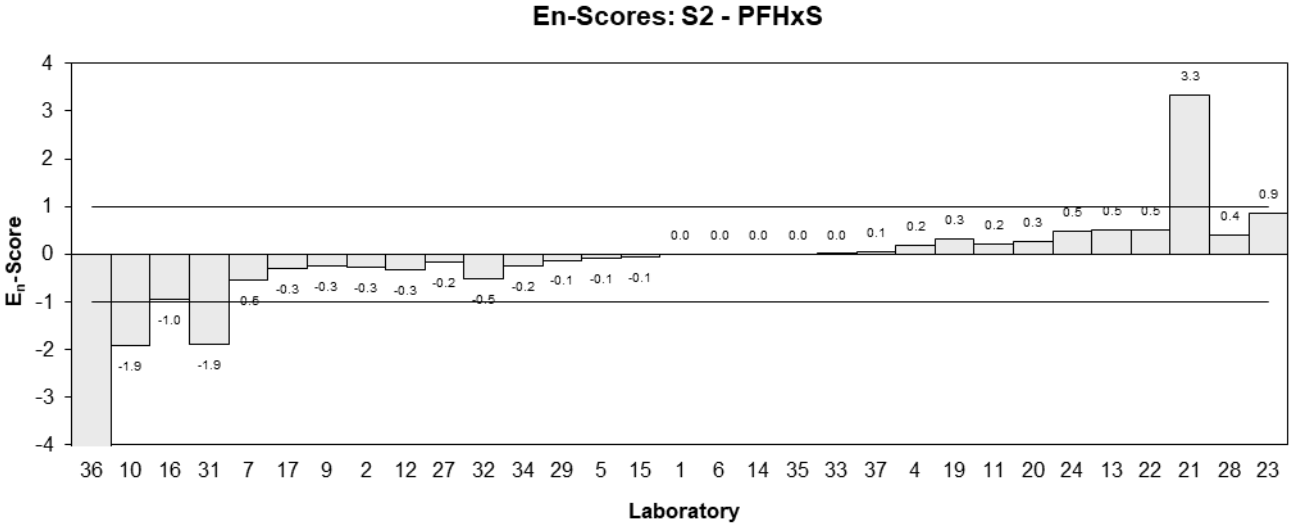

En-Scores: S2 - PFHxS
En-Score
Laboratory
36 10 16 31 7 17 9 2 12 27 32 34 29 5 15 1 6 14 35 33 37 4 19 11 20 24 13 22 21 28 23

Figure 32

Table 36

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFHxS_L |
| **Unit** | µg/kg |

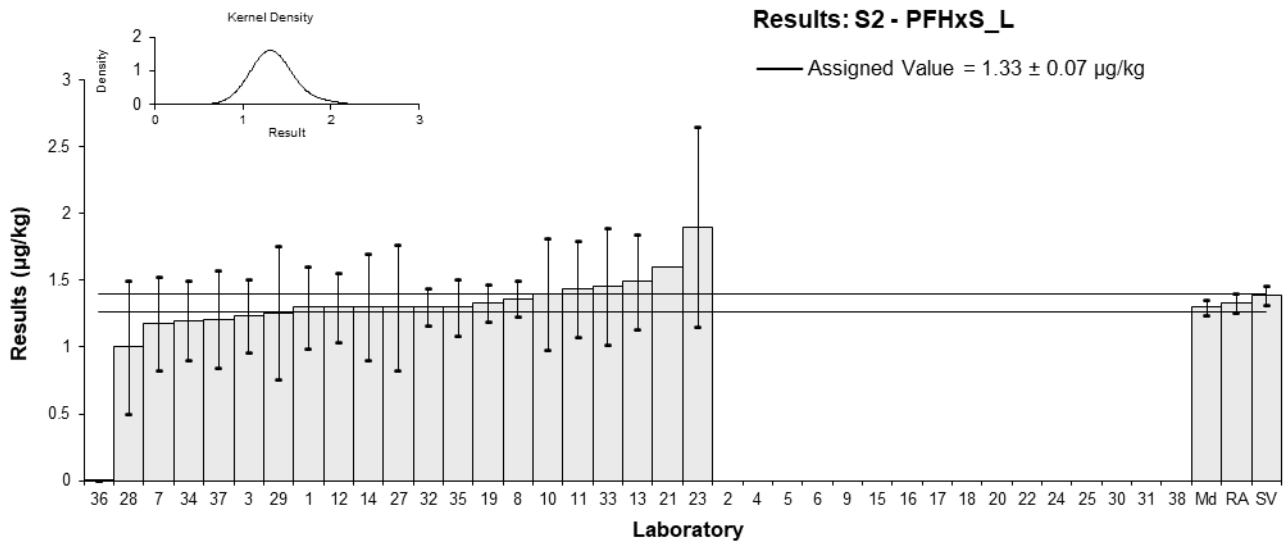
**Participant Results**

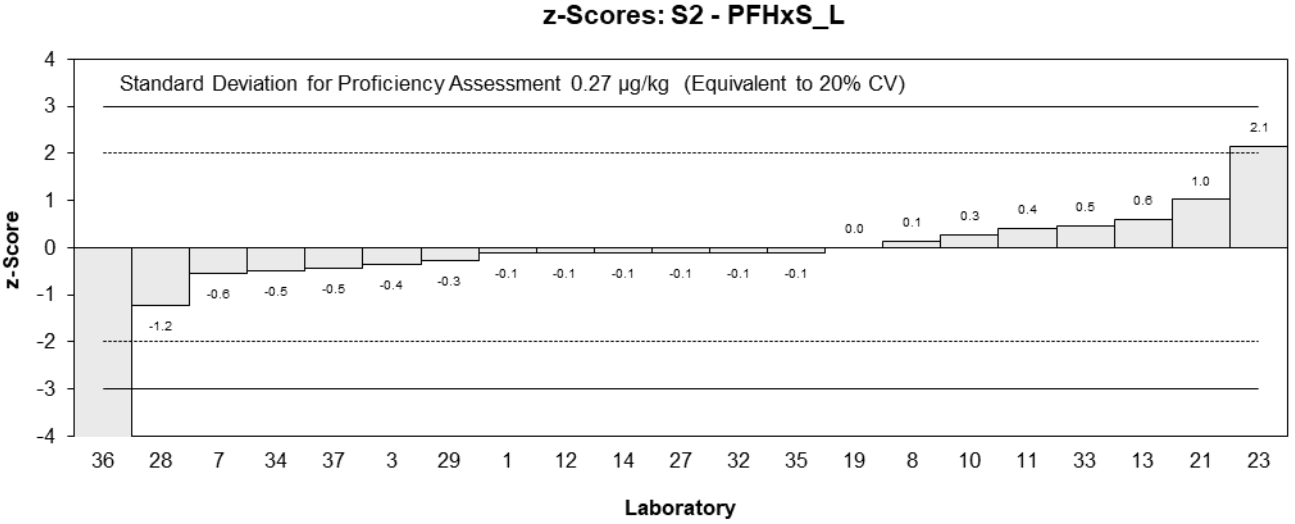
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 1.3 | 0.31 | 98 | -0.11 | -0.09 |
| **2** | NT | NT | NT | | |
| **3** | 1.236 | 0.273 | NR | -0.35 | -0.33 |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | 1.18 | 0.35 | NR | -0.56 | -0.42 |
| **8** | 1.363320 | 0.13633 | >75 | 0.13 | 0.22 |
| **9** | NT | NT | NT | | |
| **10** | 1.4 | 0.42 | 105 | 0.26 | 0.16 |
| **11** | 1.437 | 0.35925 | 98.8 | 0.40 | 0.29 |
| **12** | 1.3 | 0.26 | NR | -0.11 | -0.11 |
| **13** | 1.49 | 0.36 | NR | 0.60 | 0.44 |
| **14** | 1.3 | 0.4 | 84 | -0.11 | -0.07 |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 1.33 | 0.141 | 92 | 0.00 | 0.00 |
| **20** | NT | NT | NT | | |
| **21** | 1.6 | NR | 89 | 1.02 | 3.86 |
| **22** | NT | NT | NT | | |
| **23** | 1.9 | 0.75 | NR | 2.14 | 0.76 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 1.3 | 0.47 | NT | -0.11 | -0.06 |
| **28** | 1 | 0.5 | NR | -1.24 | -0.65 |
| **29** | 1.258 | 0.503 | NR | -0.27 | -0.14 |
| **30** | NS | NS | NS | | |
| **31** | NR | NR | NR | | |
| **32** | 1.3 | 0.14 | NR | -0.11 | -0.19 |
| **33** | 1.455 | 0.44 | 99 | 0.47 | 0.28 |
| **34** | 1.2 | 0.3 | 104 | -0.49 | -0.42 |
| **35** | 1.3 | 0.21 | 101.2 | -0.11 | -0.14 |
| **36**** | 0.001317 | 0.000065 | 94 | -5.00 | -18.98 |
| **37** | 1.21 | 0.363 | 91 | -0.45 | -0.32 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.33 | 0.07 |
| **Spike Value** | 1.39 | 0.07 |
| **Robust Average** | 1.33 | 0.07 |
| **Median** | 1.30 | 0.06 |
| **Mean** | 1.34 | |
| **N** | 20 | |
| **Max** | 1.9 | |
| **Min** | 1 | |
| **Robust SD** | 0.13 | |
| **Robust CV** | 9.6% | |


Kernel Density
Density
Result
Results: S2 - PFHxS_L
Assigned Value = 1.33 ± 0.07 µg/kg
Results (µg/kg)
Laboratory
36 28 7 34 37 3 29 1 12 14 27 32 35 19 8 10 11 33 13 21 23 2 4 5 6 9 15 16 17 18 20 22 24 25 30 31 38 Md RA SV


z-Scores: S2 - PFHxS_L
Standard Deviation for Proficiency Assessment 0.27 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 28 7 34 37 3 29 1 12 14 27 32 35 19 8 10 11 33 13 21 23

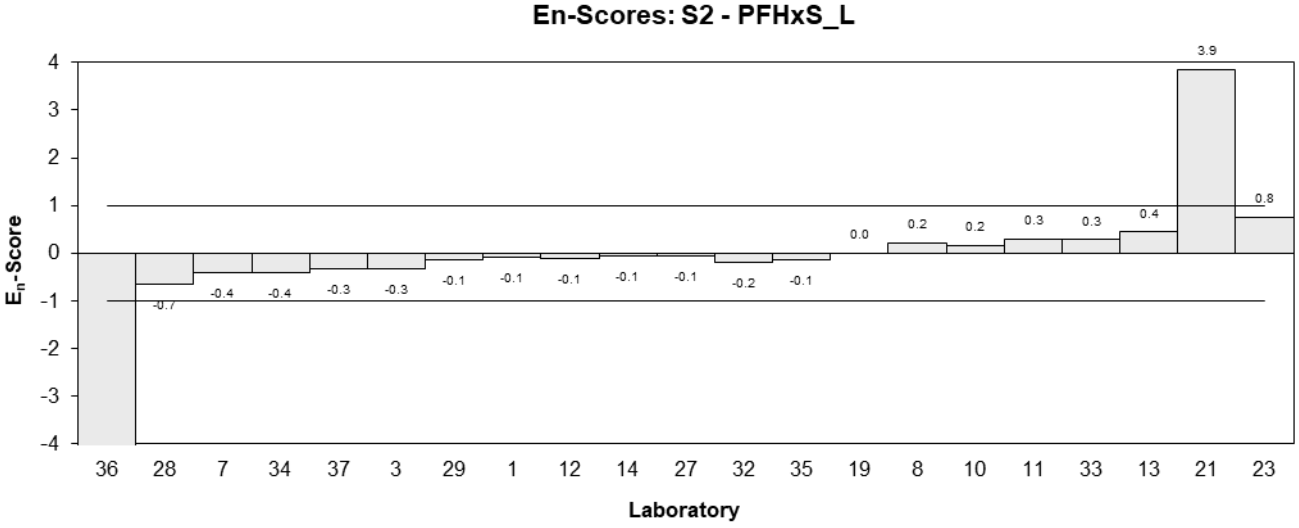

En-Scores: S2 - PFHxS_L
En-Score
Laboratory
36 28 7 34 37 3 29 1 12 14 27 32 35 19 8 10 11 33 13 21 23

Figure 33

Table 37

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFOS |
| **Unit** | µg/kg |

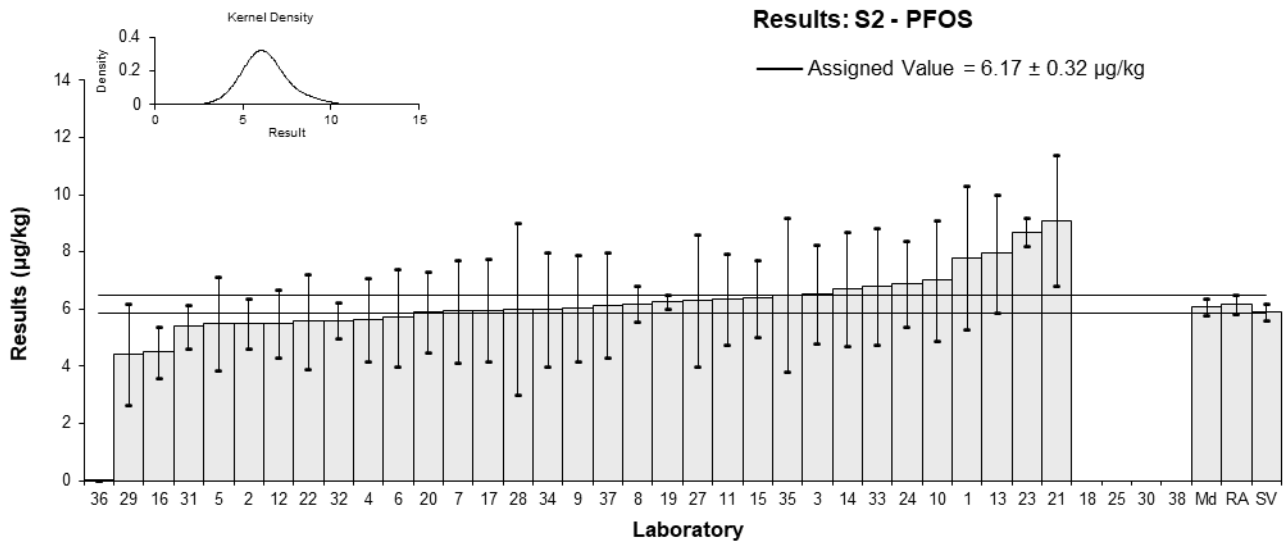
**Participant Results**

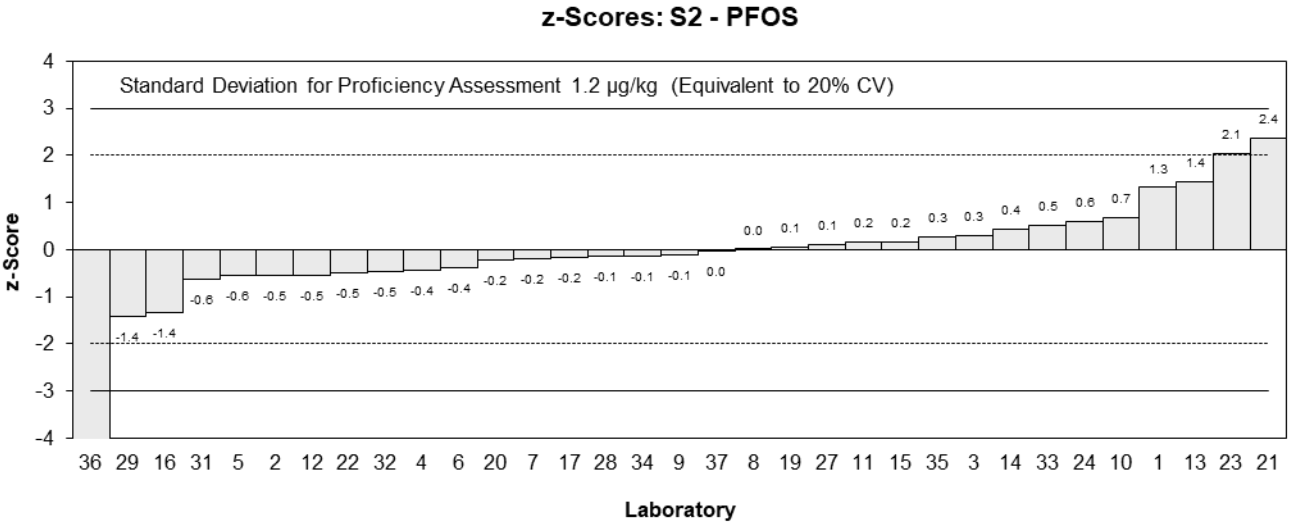
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 7.8 | 2.5 | 91 | 1.32 | 0.65 |
| **2** | 5.5 | 0.86 | NR | -0.54 | -0.73 |
| **3** | 6.531 | 1.721 | NR | 0.29 | 0.21 |
| **4** | 5.63 | 1.44 | 91 | -0.44 | -0.37 |
| **5** | 5.49041 | 1.647123 | 118 | -0.55 | -0.41 |
| **6** | 5.7 | 1.71 | 95 | -0.38 | -0.27 |
| **7** | 5.93 | 1.8 | NR | -0.19 | -0.13 |
| **8** | 6.182046 | 0.61820 | >75 | 0.01 | 0.02 |
| **9** | 6.03 | 1.87 | 100 | -0.11 | -0.07 |
| **10** | 7 | 2.1 | 100 | 0.67 | 0.39 |
| **11** | 6.355 | 1.58875 | 90.1 | 0.15 | 0.11 |
| **12** | 5.5 | 1.2 | 111 | -0.54 | -0.54 |
| **13** | 7.95 | 2.07 | 82 | 1.44 | 0.85 |
| **14** | 6.7 | 2.01 | 75 | 0.43 | 0.26 |
| **15** | 6.38 | 1.34 | NR | 0.17 | 0.15 |
| **16** | 4.5 | 0.9 | NR | -1.35 | -1.75 |
| **17** | 5.962483 | 1.788745 | 106 | -0.17 | -0.11 |
| **18** | NT | NT | NT | | |
| **19** | 6.25 | 0.257 | 90 | 0.06 | 0.19 |
| **20** | 5.89 | 1.4 | 120 | -0.23 | -0.19 |
| **21** | 9.1 | 2.3 | 103 | 2.37 | 1.26 |
| **22** | 5.57 | 1.671 | 95 | -0.49 | -0.35 |
| **23** | 8.7 | 0.5 | 92 | 2.05 | 4.26 |
| **24** | 6.9 | 1.5 | 90.14 | 0.59 | 0.48 |
| **25** | <5 | NR | NR | | |
| **27** | 6.3 | 2.3 | NT | 0.11 | 0.06 |
| **28** | 6 | 3 | 117 | -0.14 | -0.06 |
| **29** | 4.419 | 1.768 | NR | -1.42 | -0.97 |
| **30** | NS | NS | NS | | |
| **31** | 5.4 | 0.76 | 85.14 | -0.62 | -0.93 |
| **32** | 5.6 | 0.62 | NR | -0.46 | -0.82 |
| **33** | 6.795 | 2.04 | 88 | 0.51 | 0.30 |
| **34** | 6 | 2 | 89 | -0.14 | -0.08 |
| **35** | 6.5 | 2.7 | 74.3 | 0.27 | 0.12 |
| **36**** | 0.00594 | 0.00030 | 96 | -5.00 | -19.26 |
| **37** | 6.13 | 1.839 | 107 | -0.03 | -0.02 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 6.17 | 0.32 |
| **Spike Value** | 5.91 | 0.30 |
| **Robust Average** | 6.17 | 0.32 |
| **Median** | 6.08 | 0.31 |
| **Mean** | 6.27 | |
| **N** | 32 | |
| **Max** | 9.1 | |
| **Min** | 4.419 | |
| **Robust SD** | 0.73 | |
| **Robust CV** | 12% | |


Kernel Density
Density
Result
Results: S2 - PFOS
Assigned Value = 6.17 ± 0.32 µg/kg
Results (µg/kg)
Laboratory
36 29 16 31 5 2 12 22 32 4 6 20 7 17 28 34 9 37 8 19 27 11 15 35 3 14 33 24 10 1 13 23 21 18 25 30 38 Md RA SV


z-Scores: S2 - PFOS
Standard Deviation for Proficiency Assessment 1.2 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 29 16 31 5 2 12 22 32 4 6 20 7 17 28 34 9 37 8 19 27 11 15 35 3 14 33 24 10 1 13 23 21

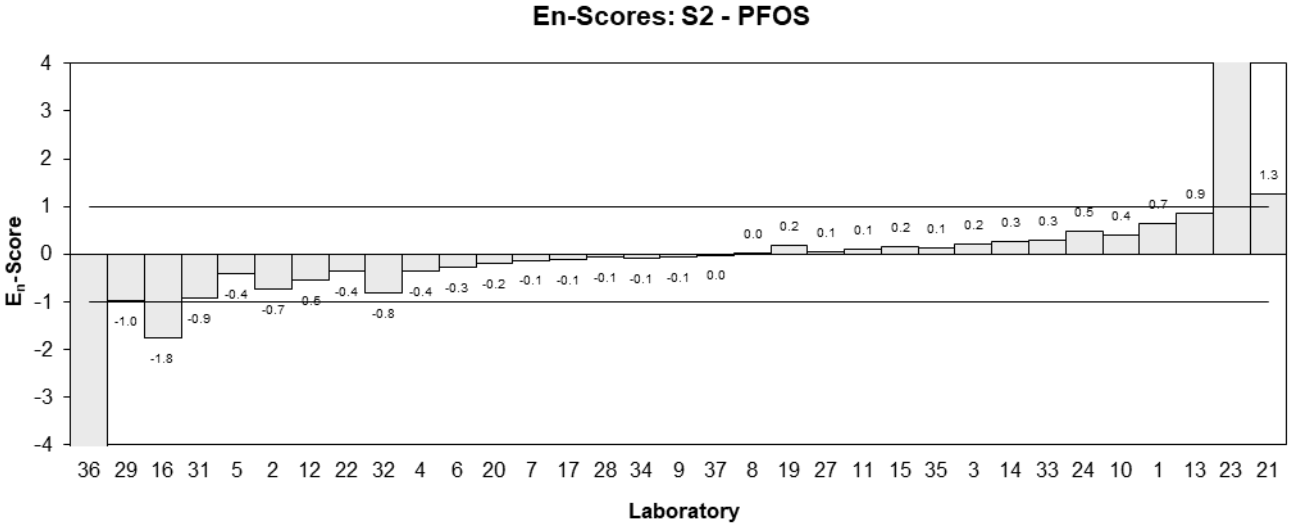

En-Scores: S2 - PFOS
En-Score
Laboratory
36 29 16 31 5 2 12 22 32 4 6 20 7 17 28 34 9 37 8 19 27 11 15 35 3 14 33 24 10 1 13 23 21

Figure 34

Table 38

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFOS_L |
| **Unit** | µg/kg |

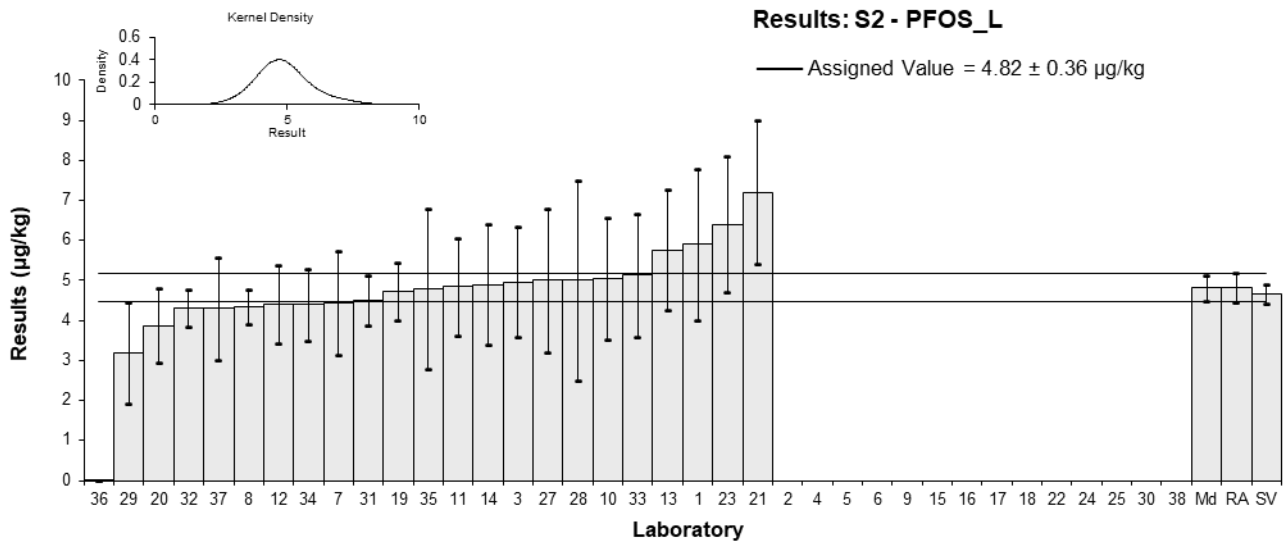
**Participant Results**

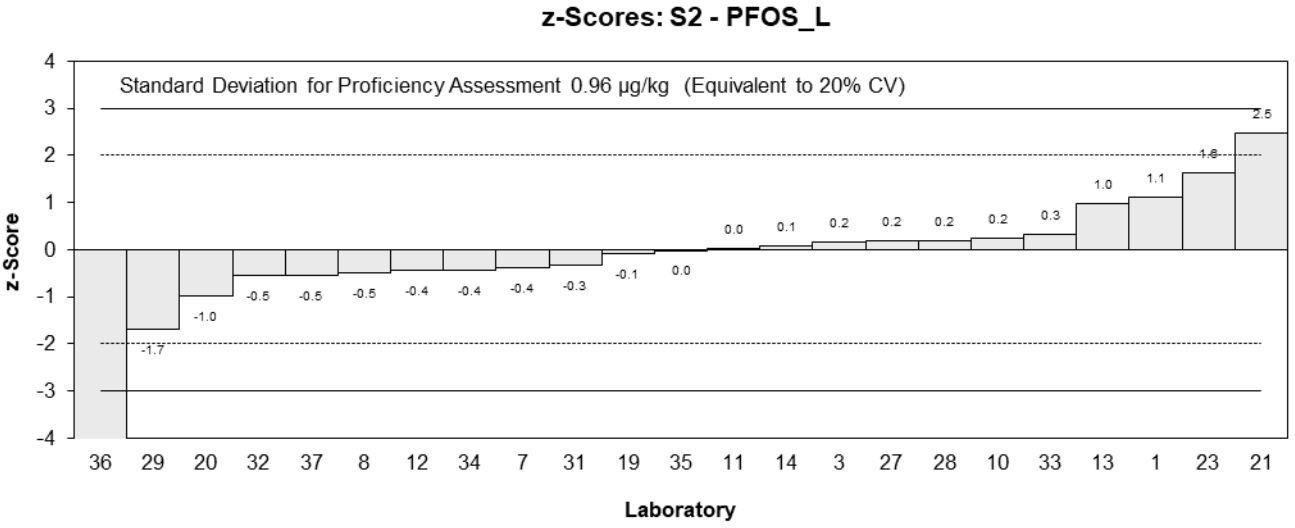
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 5.9 | 1.9 | 91 | 1.12 | 0.56 |
| **2** | NT | NT | NT | | |
| **3** | 4.966 | 1.386 | NR | 0.15 | 0.10 |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | 4.44 | 1.3 | NR | -0.39 | -0.28 |
| **8** | 4.340504 | 0.43405 | >75 | -0.50 | -0.85 |
| **9** | NT | NT | NT | | |
| **10** | 5.05 | 1.515 | 100 | 0.24 | 0.15 |
| **11** | 4.842 | 1.2105 | 90.1 | 0.02 | 0.02 |
| **12** | 4.4 | 0.98 | NR | -0.44 | -0.40 |
| **13** | 5.76 | 1.5 | NR | 0.98 | 0.61 |
| **14** | 4.9 | 1.5 | 75 | 0.08 | 0.05 |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 4.73 | 0.715 | 90 | -0.09 | -0.11 |
| **20** | 3.87 | 0.93 | 120 | -0.99 | -0.95 |
| **21** | 7.2 | 1.8 | 103 | 2.47 | 1.30 |
| **22** | NT | NT | NT | | |
| **23** | 6.4 | 1.7 | NR | 1.64 | 0.91 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 5.0 | 1.8 | NT | 0.19 | 0.10 |
| **28** | 5 | 2.5 | NR | 0.19 | 0.07 |
| **29** | 3.193 | 1.277 | NR | -1.69 | -1.23 |
| **30** | NS | NS | NS | | |
| **31** | 4.5 | 0.63 | 85.14 | -0.33 | -0.44 |
| **32** | 4.3 | 0.47 | NR | -0.54 | -0.88 |
| **33** | 5.129 | 1.54 | 88 | 0.32 | 0.20 |
| **34** | 4.4 | 0.9 | 89 | -0.44 | -0.43 |
| **35** | 4.8 | 2.0 | 74.3 | -0.02 | -0.01 |
| **36**** | 0.00446 | 0.00028 | 96 | -5.00 | -13.38 |
| **37** | 4.3 | 1.29 | 110 | -0.54 | -0.39 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.82 | 0.36 |
| **Spike Value** | 4.66 | 0.23 |
| **Robust Average** | 4.82 | 0.36 |
| **Median** | 4.82 | 0.32 |
| **Mean** | 4.88 | |
| **N** | 22 | |
| **Max** | 7.2 | |
| **Min** | 3.193 | |
| **Robust SD** | 0.68 | |
| **Robust CV** | 14% | |


Kernel Density
Density
Result
Results: S2 - PFOS_L
Assigned Value = 4.82 ± 0.36 µg/kg
Results (µg/kg)
Laboratory
36 29 20 32 37 8 12 34 7 31 19 35 11 14 3 27 28 10 33 13 1 23 21 2 4 5 6 9 15 16 17 18 22 24 25 30 38 Md RA SV


z-Scores: S2 - PFOS_L
Standard Deviation for Proficiency Assessment 0.96 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 29 20 32 37 8 12 34 7 31 19 35 11 14 3 27 28 10 33 13 1 23 21

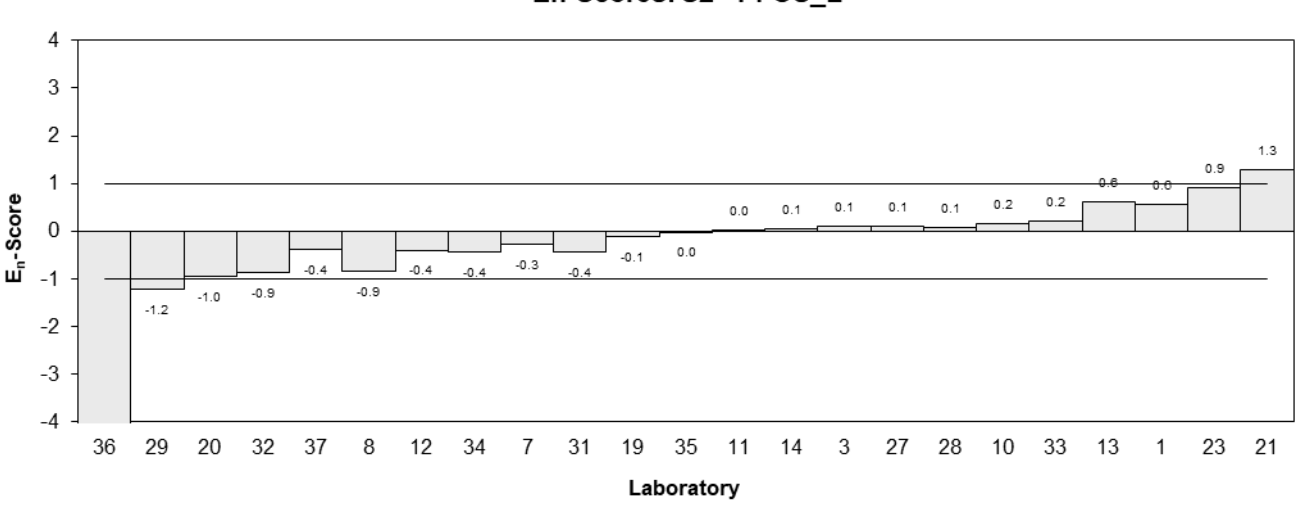

En-Scores: S2 - PFOS_L
En-Score
Laboratory
36 29 20 32 37 8 12 34 7 31 19 35 11 14 3 27 28 10 33 13 1 23 21

Figure 35

Table 39

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFUdS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NT | NT | NT |
| **3** | NT | NT | NT |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | NT | NT | NT |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | 16.298 | 4.8894 | 69.2 |
| **12** | NT | NT | NT |
| **13** | NT | NT | NT |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | NT | NT | NT |
| **20** | NT | NT | NT |
| **21** | 35 | NR | NR |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 16 | 5.8 | NT |
| **28** | NT | NT | NT |
| **29** | 17.660 | 7.064 | NR |
| **30** | NS | NS | NS |
| **31** | NR | NR | NR |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | 16 | 4.8 | 74.3 |
| **36** | NT | NT | NT |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 19.6 | 1.0 |
| **Robust Average** | NA (N<6) | |
| **Median** | 16.3 | 0.5 |
| **Mean** | 20.2 | |
| **N** | 5 | |
| **Max** | 35 | |
| **Min** | 16 | |
| **Robust SD** | NA (N<6) | |
| **Robust CV** | NA (N<6) | |

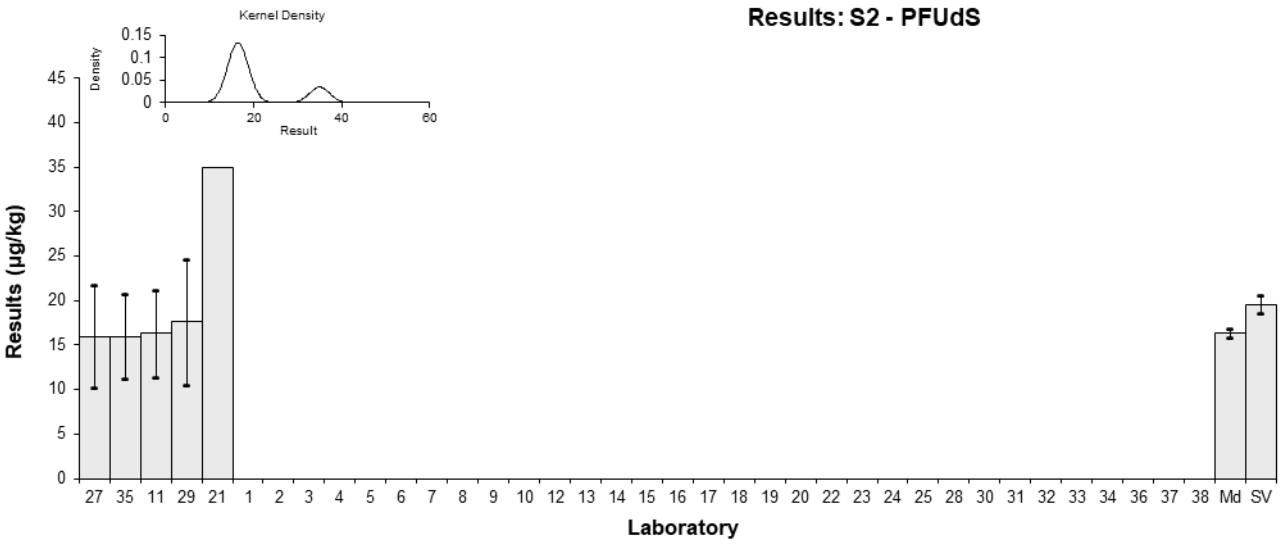

Results: S2 - PFUdS
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
27 35 11 29 21 1 2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 18 19 20 22 23 24 25 28 30 31 32 33 34 36 37 38 Md SV

Figure 36

Table 40

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFDoS |
| **Unit** | µg/kg |

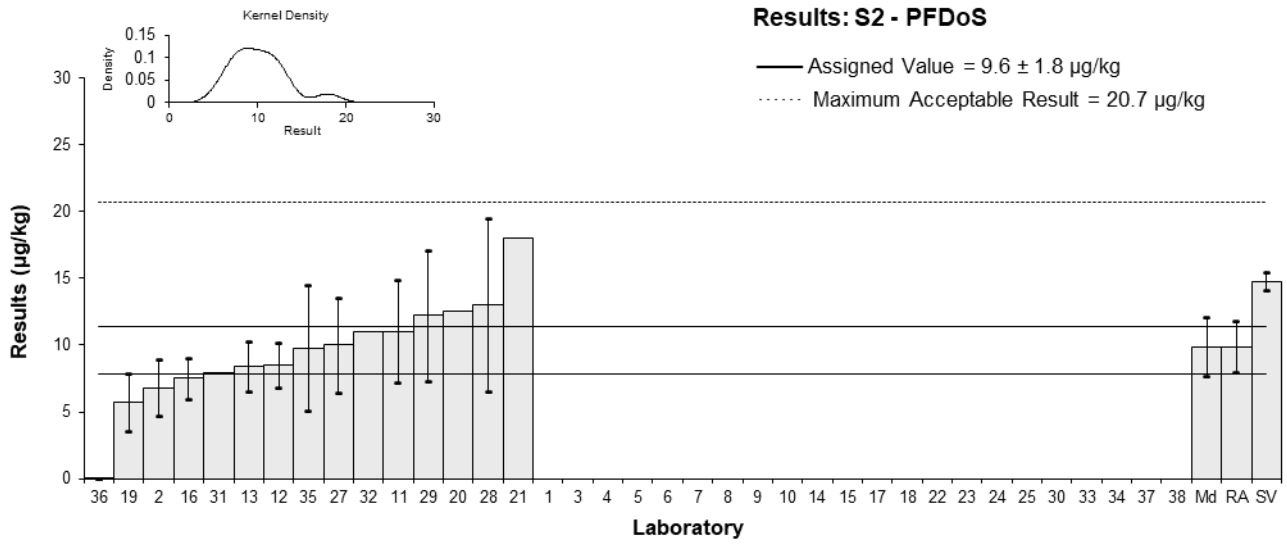
**Participant Results**

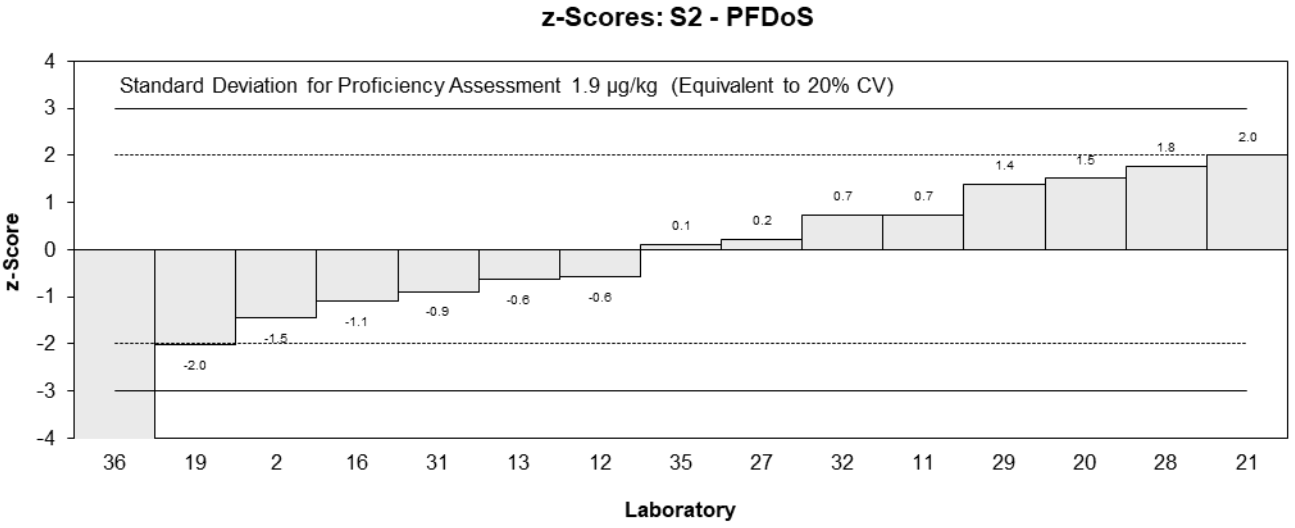
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NT | NT | NT | | |
| **2** | 6.8 | 2.13 | NR | -1.46 | -1.00 |
| **3** | NT | NT | NT | | |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | <0.001 | NR | NR | | |
| **7** | NT | NT | NT | | |
| **8** | NT | NT | NT | | |
| **9** | NT | NT | NT | | |
| **10** | NT | NT | NT | | |
| **11** | 11.021 | 3.85735 | 53.9 | 0.74 | 0.33 |
| **12** | 8.5 | 1.7 | NR | -0.57 | -0.44 |
| **13** | 8.41 | 1.85 | NR | -0.62 | -0.46 |
| **14** | NT | NT | NT | | |
| **15** | NR | NR | NR | | |
| **16** | 7.5 | 1.5 | NR | -1.09 | -0.90 |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 5.73 | 2.15 | 91 | -2.02 | -1.38 |
| **20** | 12.5 | NR | 61 | 1.51 | 1.61 |
| **21*** | 18 | NR | NR | 2.00▼ | |
| **22** | <0.001 | NR | NR | | |
| **23** | NT | NT | NT | | |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27** | 10 | 3.6 | NT | 0.21 | 0.10 |
| **28** | 13 | 6.5 | NR | 1.77 | 0.50 |
| **29** | 12.245 | 4.898 | NR | 1.38 | 0.51 |
| **30** | NS | NS | NS | | |
| **31** | 7.9 | NR | 101.35 | -0.89 | -0.94 |
| **32** | 11 | NR | NR | 0.73 | 0.78 |
| **33** | NT | NT | NT | | |
| **34** | NT | NT | NT | | |
| **35** | 9.8 | 4.7 | 74.3 | 0.10 | 0.04 |
| **36**** | 0.00751 | 0.00038 | 96 | -5.00 | -5.33 |
| **37** | NT | NT | NT | | |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2; ▼ Adjusted Score, see Section 6.3

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 9.6 | 1.8 |
| **Spike Value** | 14.8 | 0.7 |
| **Robust Average** | 9.9 | 1.9 |
| **Max Acceptable Result** | 20.7 | |
| **Median** | 9.9 | 2.2 |
| **Mean** | 10.2 | |
| **N** | 14 | |
| **Max** | 18 | |
| **Min** | 5.73 | |
| **Robust SD** | 2.9 | |
| **Robust CV** | 29% | |


Kernel Density
Density
Result
Results: S2 - PFDoS
Assigned Value = 9.6 ± 1.8 µg/kg
Maximum Acceptable Result = 20.7 µg/kg
Results (µg/kg)
36 19 2 16 31 13 12 35 27 32 11 29 20 28 21 1 3 4 5 6 7 8 9 10 14 15 17 18 22 23 24 25 30 33 34 37 38 Md RA SV
Laboratory


z-Scores: S2 - PFDoS
Standard Deviation for Proficiency Assessment 1.9 µg/kg (Equivalent to 20% CV)
z-Score
-2.0 -1.5 -1.1 -0.9 -0.6 -0.6 0.1 0.2 0.7 0.7 1.4 1.5 1.8 2.0
36 19 2 16 31 13 12 35 27 32 11 29 20 28 21
Laboratory

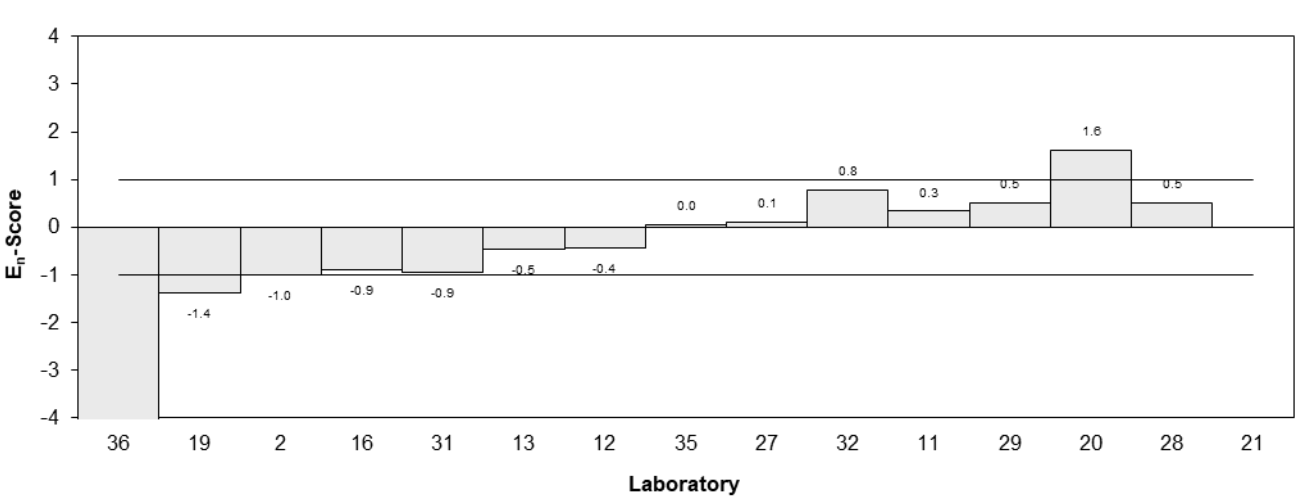

En-Scores: S2 - PFDoS
En-Score
-1.4 -1.0 -0.9 -0.9 -0.5 -0.4 0.0 0.1 0.8 0.3 0.5 1.6 0.5
36 19 2 16 31 13 12 35 27 32 11 29 20 28 21
Laboratory

Figure 37

Table 41

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFTrDS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NT | NT | NT |
| **3** | NT | NT | NT |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | NT | NT | NT |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | 10.319 | 3.61165 | 80.1 |
| **12** | NT | NT | NT |
| **13** | NT | NT | NT |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | NT | NT | NT |
| **20** | NT | NT | NT |
| **21** | 34 | NR | NR |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 8.3 | 3.0 | NT |
| **28** | NT | NT | NT |
| **29** | 20.710 | 8.284 | NR |
| **30** | NS | NS | NS |
| **31** | NR | NR | NR |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | 9.1 | 8.1 | 74.3 |
| **36** | NT | NT | NT |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 14.6 | 0.7 |
| **Robust Average** | NA (N<6) | |
| **Median** | 10.3 | 3.3 |
| **Mean** | 16.5 | |
| **N** | 5 | |
| **Max** | 34 | |
| **Min** | 8.3 | |
| **Robust SD** | NA (N<6) | |
| **Robust CV** | NA (N<6) | |

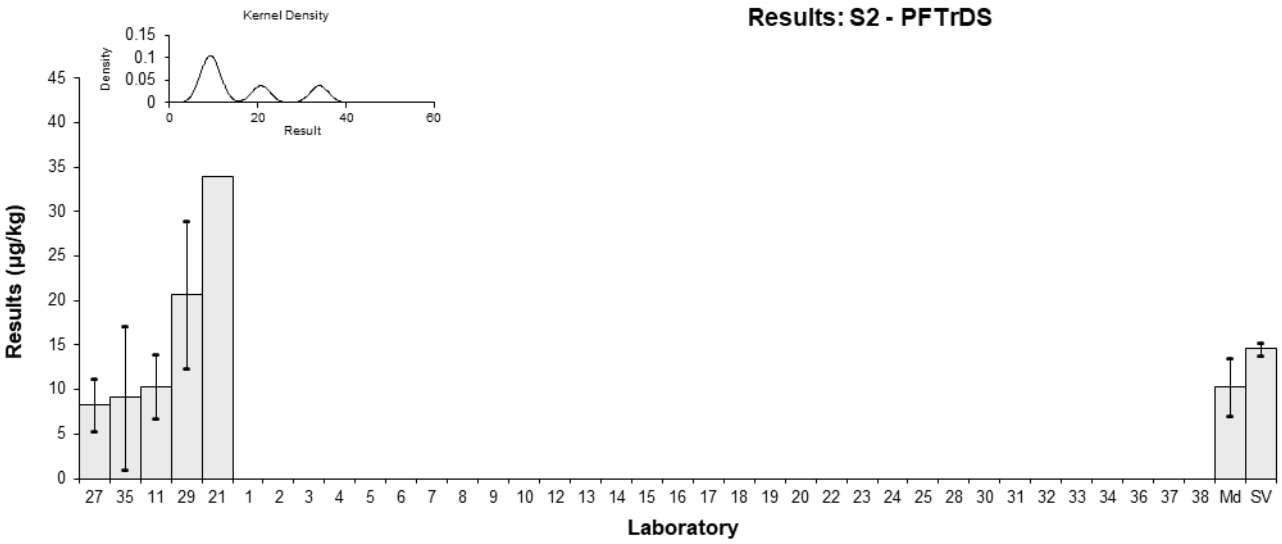

Results: S2 - PFTrDS
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
27 35 11 29 21 1 2 3 4 5 6 7 8 9 10 12 13 14 15 16 17 18 19 20 22 23 24 25 28 30 31 32 33 34 36 37 38 Md SV

Figure 38

Table 42

**Sample Details**

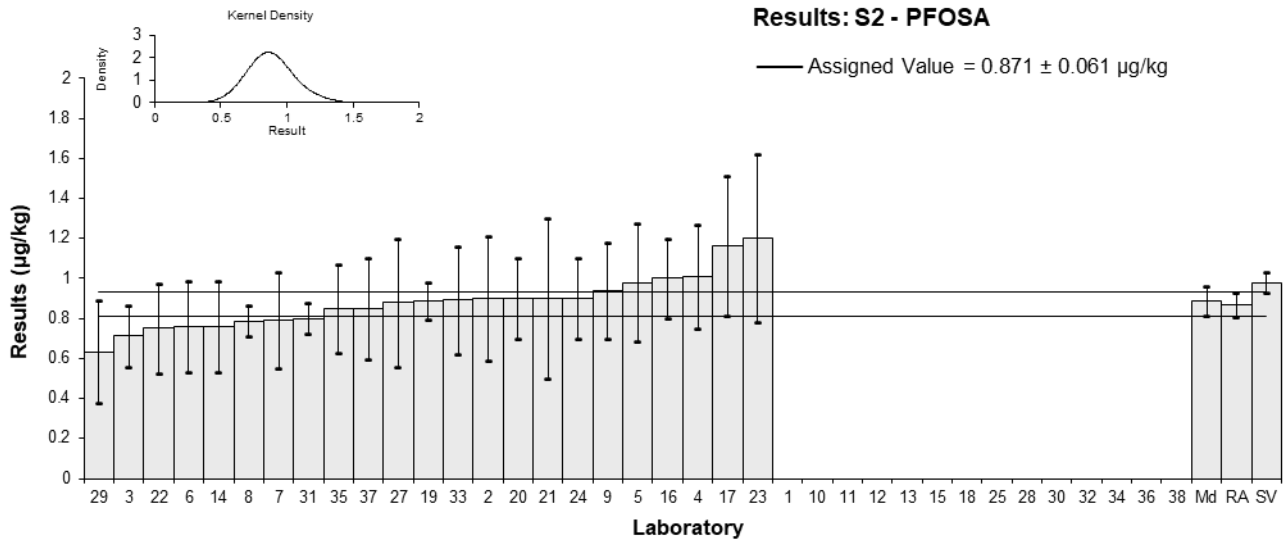
| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFOSA |
| **Unit** | µg/kg |

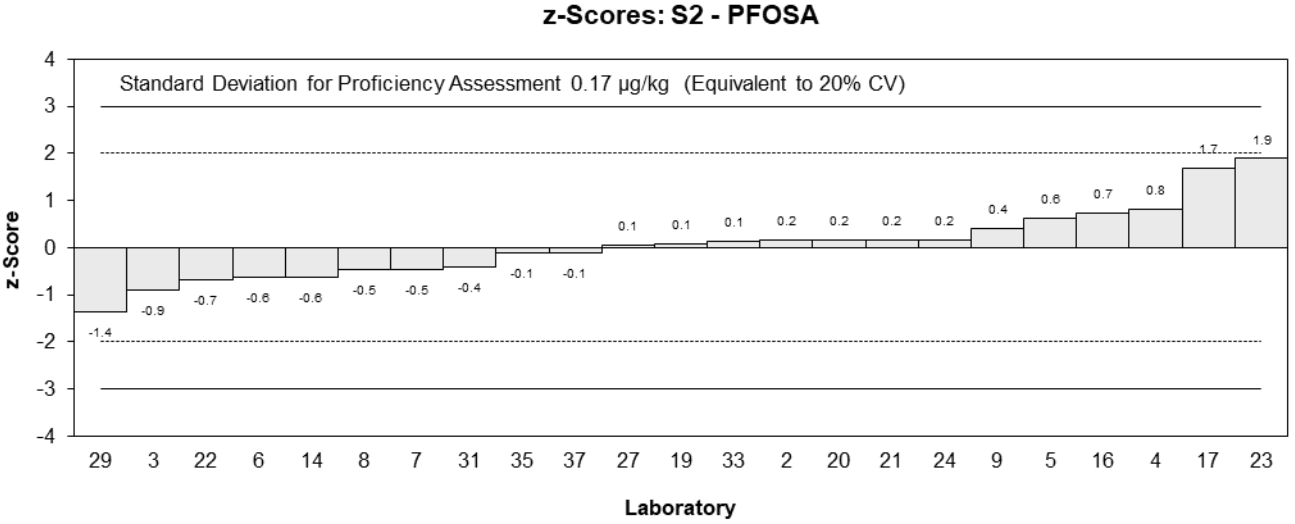
**Participant Results**

| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <1.0 | NR | 94 | | |
| **2** | 0.9 | 0.31 | NR | 0.17 | 0.09 |
| **3** | 0.712 | 0.153 | NR | -0.91 | -0.97 |
| **4** | 1.012 | 0.26 | 87 | 0.81 | 0.53 |
| **5** | 0.9795 | 0.29385 | 74 | 0.62 | 0.36 |
| **6** | 0.76 | 0.228 | 100 | -0.64 | -0.47 |
| **7** | 0.79 | 0.24 | NR | -0.46 | -0.33 |
| **8** | 0.787227 | 0.07872 | >75 | -0.48 | -0.84 |
| **9** | 0.94 | 0.24 | 99 | 0.40 | 0.28 |
| **10** | <1 | NR | 100 | | |
| **11** | NR | NR | NR | | |
| **12** | NR | NR | NR | | |
| **13** | <1 | NR | NR | | |
| **14** | 0.76 | 0.23 | 94 | -0.64 | -0.47 |
| **15** | NR | NR | NR | | |
| **16** | 1.0000 | 0.2 | NR | 0.74 | 0.62 |
| **17** | 1.164566 | 0.349369 | 84 | 1.69 | 0.83 |
| **18** | <5 | NR | NR | | |
| **19** | 0.887 | 0.0931 | 66 | 0.09 | 0.14 |
| **20** | 0.9 | 0.2 | 98 | 0.17 | 0.14 |
| **21** | 0.9 | 0.4 | 81 | 0.17 | 0.07 |
| **22** | 0.75 | 0.225 | 100 | -0.69 | -0.52 |
| **23** | 1.2 | 0.42 | 85 | 1.89 | 0.78 |
| **24** | 0.9 | 0.2 | 86.75 | 0.17 | 0.14 |
| **25** | <5 | NR | NR | | |
| **27** | 0.88 | 0.32 | NT | 0.05 | 0.03 |
| **28** | < 10 | 5 | 111 | | |
| **29** | 0.634 | 0.254 | NR | -1.36 | -0.91 |
| **30** | NS | NS | NS | | |
| **31** | 0.8 | 0.078 | 78.5 | -0.41 | -0.72 |
| **32** | <1 | NR | NR | | |
| **33** | 0.893 | 0.27 | 54 | 0.13 | 0.08 |
| **34** | <1 | NR | 97 | | |
| **35** | 0.85 | 0.22 | 105.7 | -0.12 | -0.09 |
| **36** | < 0.0010 | 0.000085 | 102 | | |
| **37** | 0.85 | 0.255 | 98 | -0.12 | -0.08 |
| **38** | NS | NS | NS | | |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 0.871 | 0.061 |
| **Spike Value** | 0.980 | 0.049 |
| **Robust Average** | 0.871 | 0.061 |
| **Median** | 0.887 | 0.072 |
| **Mean** | 0.880 | |
| **N** | 23 | |
| **Max** | 1.2 | |
| **Min** | 0.634 | |
| **Robust SD** | 0.12 | |
| **Robust CV** | 13% | |


Kernel Density
Density
Result
Results: S2 - PFOSA
Assigned Value = 0.871 ± 0.061 µg/kg
Results (µg/kg)
29 3 22 6 14 8 7 31 35 37 27 19 33 2 20 21 24 9 5 16 4 17 23 1 10 11 12 13 15 18 25 28 30 32 34 36 38 Md RA SV
Laboratory


z-Scores: S2 - PFOSA
Standard Deviation for Proficiency Assessment 0.17 µg/kg (Equivalent to 20% CV)
z-Score
-1.4 -0.9 -0.7 -0.6 -0.6 -0.5 -0.5 -0.4 -0.1 -0.1 0.1 0.1 0.1 0.2 0.2 0.2 0.2 0.4 0.6 0.7 0.8 1.7 1.9
29 3 22 6 14 8 7 31 35 37 27 19 33 2 20 21 24 9 5 16 4 17 23
Laboratory

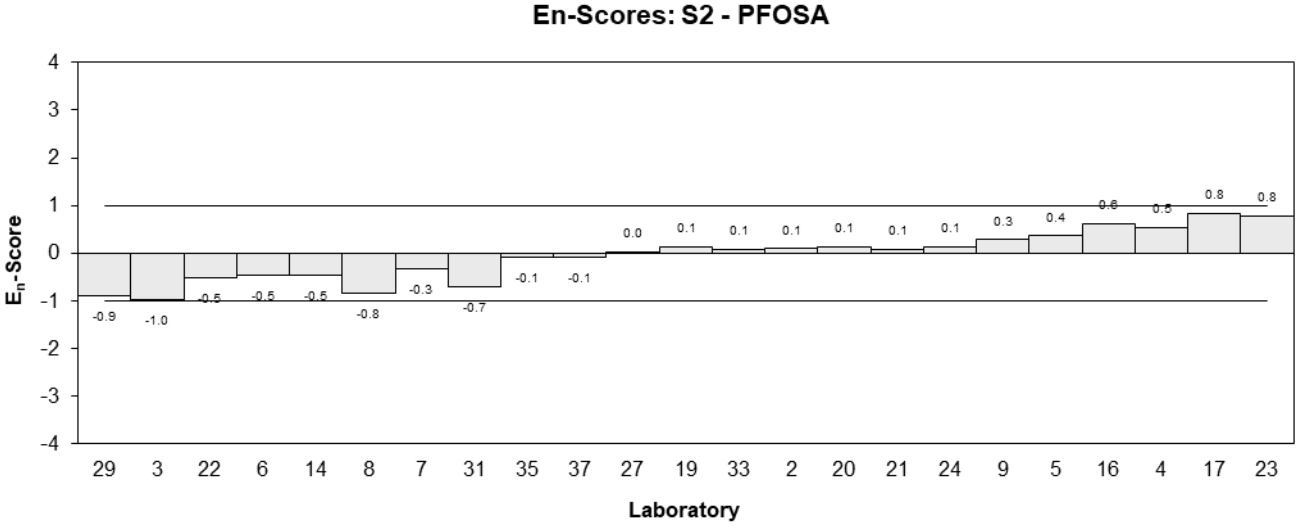

En-Scores: S2 - PFOSA
En-Score
-0.9 -1.0 -0.5 -0.5 -0.5 -0.8 -0.3 -0.7 -0.1 -0.1 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.3 0.4 0.6 0.5 0.8 0.8
29 3 22 6 14 8 7 31 35 37 27 19 33 2 20 21 24 9 5 16 4 17 23
Laboratory

Figure 39

Table 43

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | EtFOSA |
| **Unit** | µg/kg |

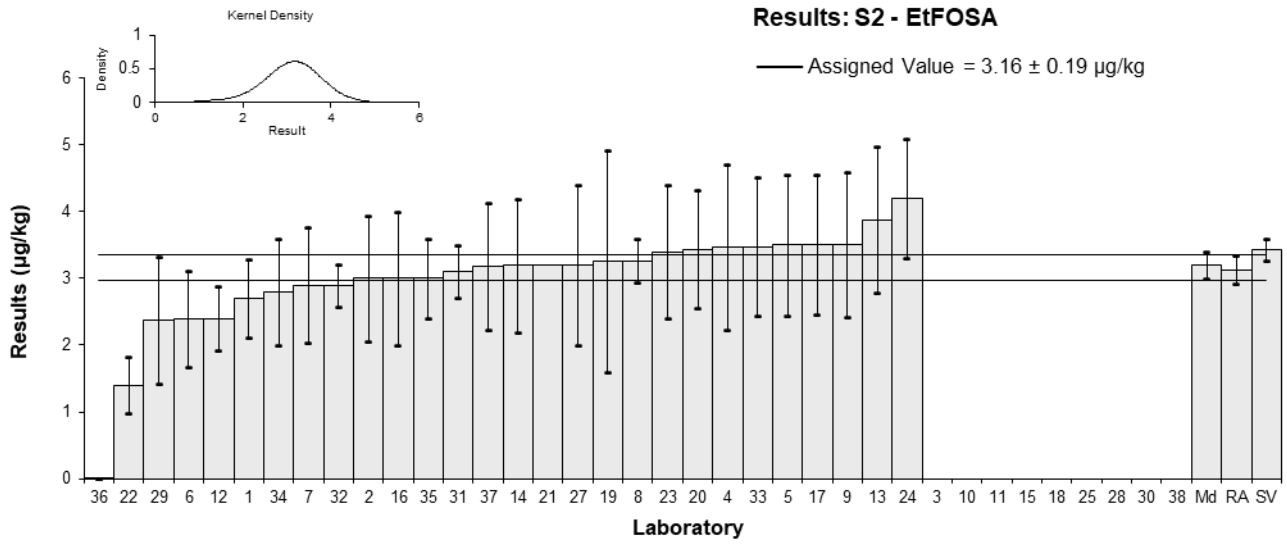
**Participant Results**

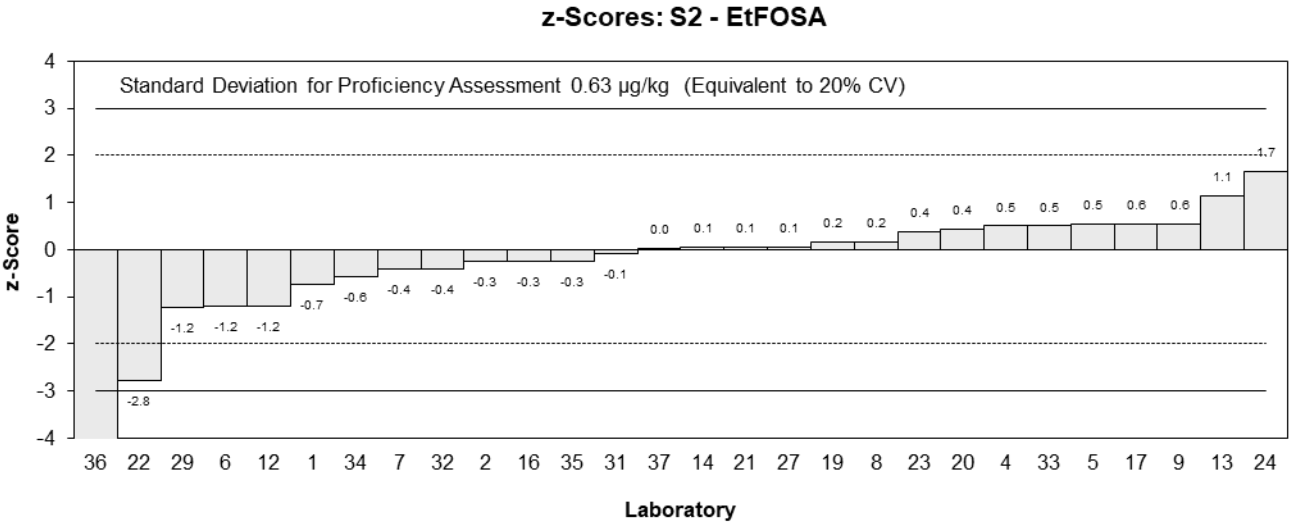
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.7 | 0.58 | 86 | -0.73 | -0.75 |
| **2** | 3 | 0.94 | NR | -0.25 | -0.17 |
| **3** | NT | NT | NT | | |
| **4** | 3.477 | 1.24 | 105 | 0.50 | 0.25 |
| **5** | 3.49924 | 1.049772 | 79 | 0.54 | 0.32 |
| **6** | 2.4 | 0.72 | 108 | -1.20 | -1.02 |
| **7** | 2.9 | 0.87 | NR | -0.41 | -0.29 |
| **8** | 3.260939 | 0.32609 | >75 | 0.16 | 0.27 |
| **9** | 3.51 | 1.09 | 87 | 0.55 | 0.32 |
| **10** | <1 | NR | 100 | | |
| **11** | NR | NR | NR | | |
| **12** | 2.4 | 0.48 | 98 | -1.20 | -1.47 |
| **13** | 3.88 | 1.09 | 40 | 1.14 | 0.65 |
| **14** | 3.2 | 1 | 108 | 0.06 | 0.04 |
| **15** | NR | NR | NR | | |
| **16** | 3 | 1 | NR | -0.25 | -0.16 |
| **17** | 3.509741 | 1.052922 | 82 | 0.55 | 0.33 |
| **18** | <5 | NR | NR | | |
| **19** | 3.26 | 1.67 | 30 | 0.16 | 0.06 |
| **20** | 3.44 | 0.89 | 91 | 0.44 | 0.31 |
| **21** | 3.2 | NR | 72 | 0.06 | 0.21 |
| **22*** | 1.40 | 0.421 | 108 | -2.78 | -3.81 |
| **23** | 3.4 | 1 | 82 | 0.38 | 0.24 |
| **24** | 4.2 | 0.9 | 75.08 | 1.65 | 1.13 |
| **25** | <5 | NR | NR | | |
| **27** | 3.2 | 1.2 | NT | 0.06 | 0.03 |
| **28** | < 5 | 2.5 | 52 | | |
| **29** | 2.381 | 0.952 | NR | -1.23 | -0.80 |
| **30** | NS | NS | NS | | |
| **31** | 3.1 | 0.39 | 101.35 | -0.09 | -0.14 |
| **32** | 2.9 | 0.32 | NR | -0.41 | -0.70 |
| **33** | 3.478 | 1.04 | 77 | 0.50 | 0.30 |
| **34** | 2.8 | 0.8 | 86 | -0.57 | -0.44 |
| **35** | 3.0 | 0.60 | 80.9 | -0.25 | -0.25 |
| **36**** | 0.0027 | 0.00019 | 95 | -5.00 | -16.62 |
| **37** | 3.18 | 0.954 | 91 | 0.03 | 0.02 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 3.16 | 0.19 |
| **Spike Value** | 3.43 | 0.17 |
| **Robust Average** | 3.13 | 0.21 |
| **Median** | 3.20 | 0.20 |
| **Mean** | 3.10 | |
| **N** | 27 | |
| **Max** | 4.2 | |
| **Min** | 1.4 | |
| **Robust SD** | 0.45 | |
| **Robust CV** | 14% | |


Kernel Density
Density
Result
Results: S2 - EtFOSA
Assigned Value = 3.16 ± 0.19 µg/kg
Results (µg/kg)
36 22 29 6 12 1 34 7 32 2 16 35 31 37 14 21 27 19 8 23 20 4 33 5 17 9 13 24 3 10 11 15 18 25 28 30 38 Md RA SV
Laboratory


z-Scores: S2 - EtFOSA
Standard Deviation for Proficiency Assessment 0.63 µg/kg (Equivalent to 20% CV)
z-Score
36 22 29 6 12 1 34 7 32 2 16 35 31 37 14 21 27 19 8 23 20 4 33 5 17 9 13 24
Laboratory

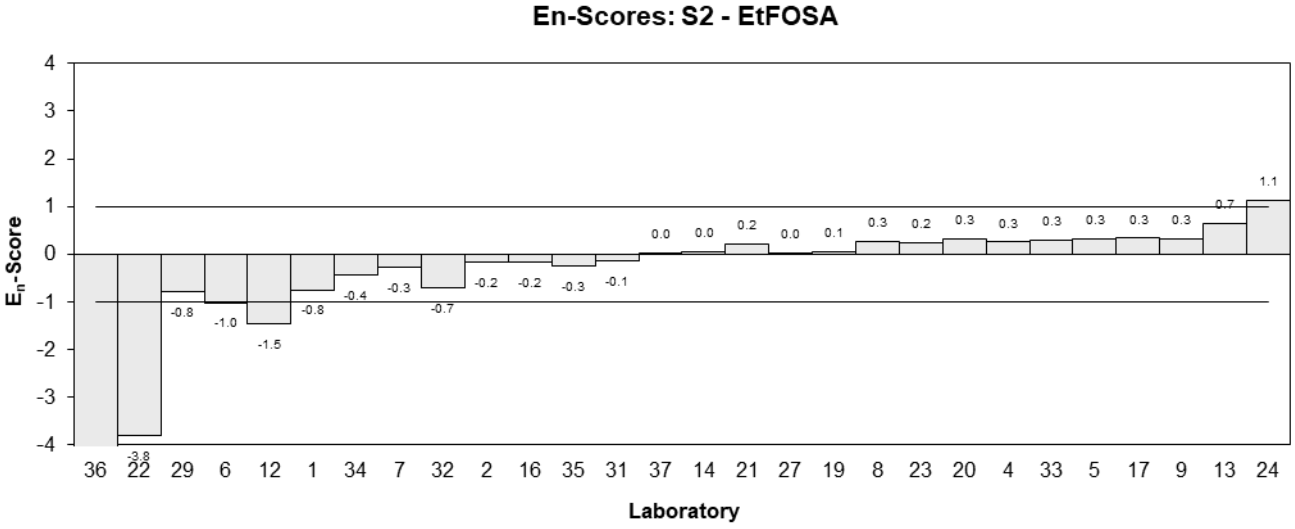

En-Scores: S2 - EtFOSA
En-Score
36 22 29 6 12 1 34 7 32 2 16 35 31 37 14 21 27 19 8 23 20 4 33 5 17 9 13 24
Laboratory

Figure 40

Table 44

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | MeFOSAA |
| **Unit** | µg/kg |

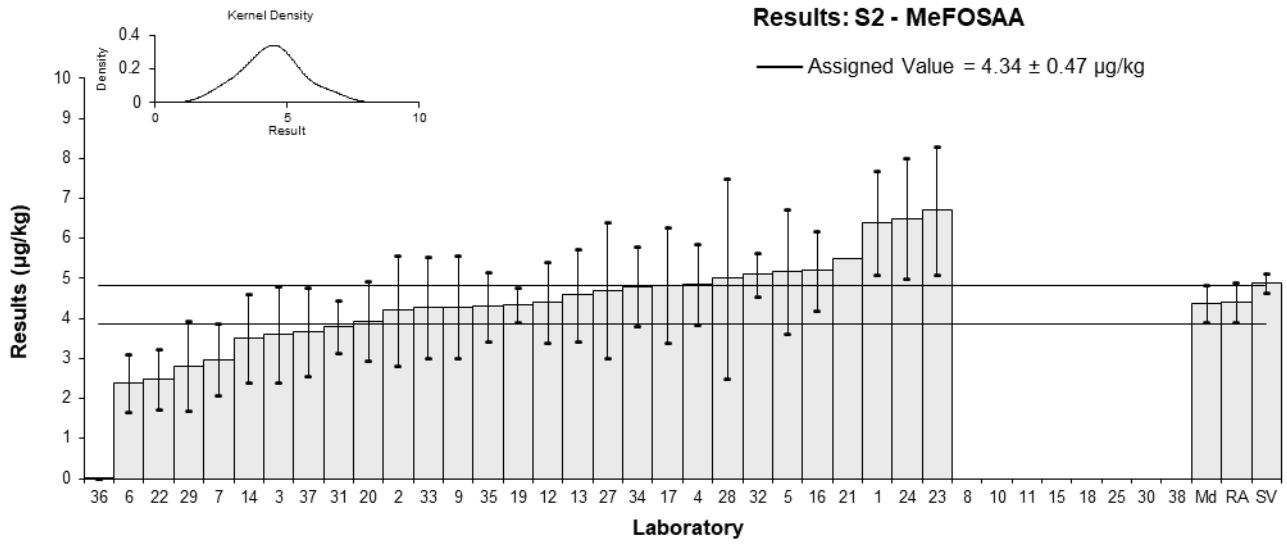
**Participant Results**

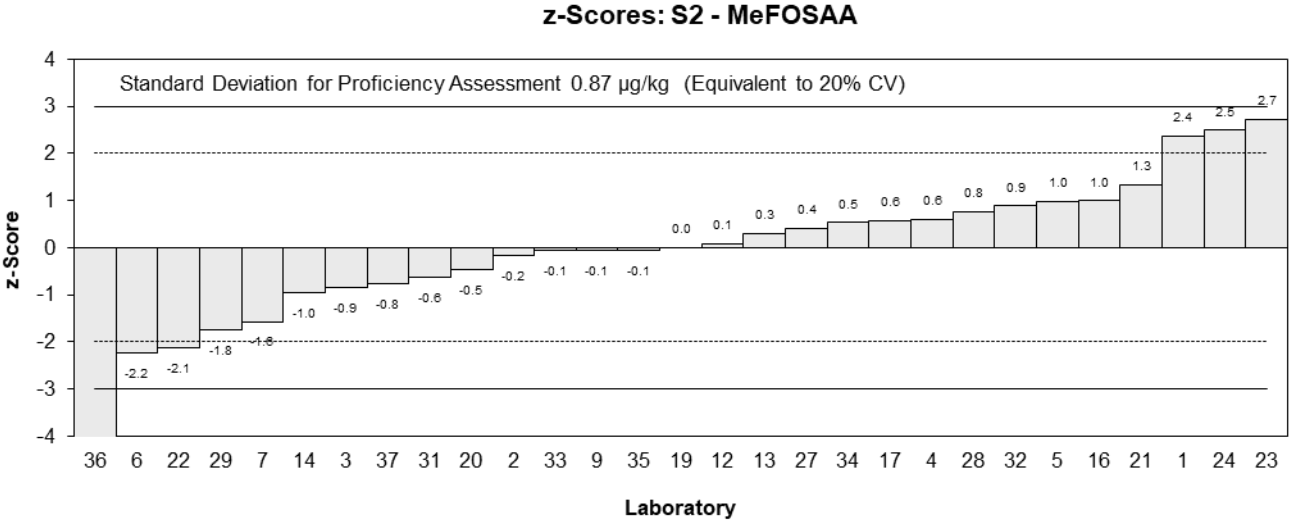
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 6.4 | 1.3 | 96 | 2.37 | 1.49 |
| **2** | 4.2 | 1.37 | NR | -0.16 | -0.10 |
| **3** | 3.597 | 1.195 | NR | -0.86 | -0.58 |
| **4** | 4.862 | 1.01 | 104 | 0.60 | 0.47 |
| **5** | 5.18156 | 1.554468 | 96 | 0.97 | 0.52 |
| **6** | 2.4 | 0.72 | 81 | -2.24 | -2.26 |
| **7** | 2.98 | 0.9 | NR | -1.57 | -1.34 |
| **8** | < 0.1 | NR | NR | | |
| **9** | 4.29 | 1.29 | 104 | -0.06 | -0.04 |
| **10** | <1 | NR | 99 | | |
| **11** | NR | NR | NR | | |
| **12** | 4.4 | 1.0 | 107 | 0.07 | 0.05 |
| **13** | 4.59 | 1.15 | 69 | 0.29 | 0.20 |
| **14** | 3.5 | 1.1 | 87 | -0.97 | -0.70 |
| **15** | NR | NR | NR | | |
| **16** | 5.2 | 1 | NR | 0.99 | 0.78 |
| **17** | 4.834703 | 1.450411 | 157 | 0.57 | 0.32 |
| **18** | <5 | NR | NR | | |
| **19** | 4.34 | 0.433 | 45 | 0.00 | 0.00 |
| **20** | 3.93 | 0.99 | 138 | -0.47 | -0.37 |
| **21** | 5.5 | NR | 93 | 1.34 | 2.47 |
| **22** | 2.48 | 0.745 | 81 | -2.14 | -2.11 |
| **23*** | 6.7 | 1.6 | 91 | 2.72 | 1.42 |
| **24** | 6.5 | 1.5 | 72.23 | 2.49 | 1.37 |
| **25** | <5 | NR | NR | | |
| **27** | 4.7 | 1.7 | NT | 0.41 | 0.20 |
| **28** | 5 | 2.5 | 105 | 0.76 | 0.26 |
| **29** | 2.814 | 1.126 | NR | -1.76 | -1.25 |
| **30** | NS | NS | NS | | |
| **31** | 3.8 | 0.65 | 80.53 | -0.62 | -0.67 |
| **32** | 5.1 | 0.54 | NR | 0.88 | 1.06 |
| **33** | 4.277 | 1.28 | 94 | -0.07 | -0.05 |
| **34** | 4.8 | 1 | 112 | 0.53 | 0.42 |
| **35** | 4.3 | 0.86 | 106.0 | -0.05 | -0.04 |
| **36**** | 0.00431 | 0.00030 | 112 | -5.00 | -9.22 |
| **37** | 3.68 | 1.104 | 91 | -0.76 | -0.55 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.34 | 0.47 |
| **Spike Value** | 4.90 | 0.24 |
| **Robust Average** | 4.41 | 0.50 |
| **Median** | 4.37 | 0.46 |
| **Mean** | 4.44 | |
| **N** | 28 | |
| **Max** | 6.7 | |
| **Min** | 2.4 | |
| **Robust SD** | 1.1 | |
| **Robust CV** | 24% | |


Kernel Density
Density
Result
Results: S2 - MeFOSAA
Assigned Value = 4.34 ± 0.47 µg/kg
Results (µg/kg)
Laboratory
36 6 22 29 7 14 3 37 31 20 2 33 9 35 19 12 13 27 34 17 4 28 32 5 16 21 1 24 23 8 10 11 15 18 25 30 38 Md RA SV


z-Scores: S2 - MeFOSAA
Standard Deviation for Proficiency Assessment 0.87 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 6 22 29 7 14 3 37 31 20 2 33 9 35 19 12 13 27 34 17 4 28 32 5 16 21 1 24 23

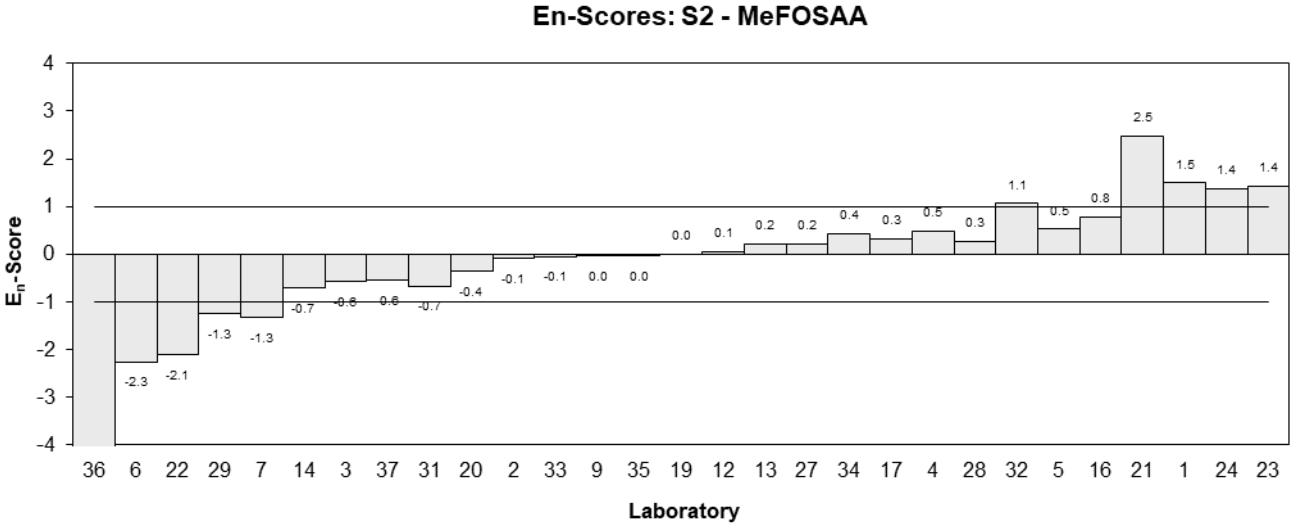

En-Scores: S2 - MeFOSAA
En-Score
Laboratory
36 6 22 29 7 14 3 37 31 20 2 33 9 35 19 12 13 27 34 17 4 28 32 5 16 21 1 24 23

Figure 41

Table 45

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | MeFOSE |
| **Unit** | µg/kg |

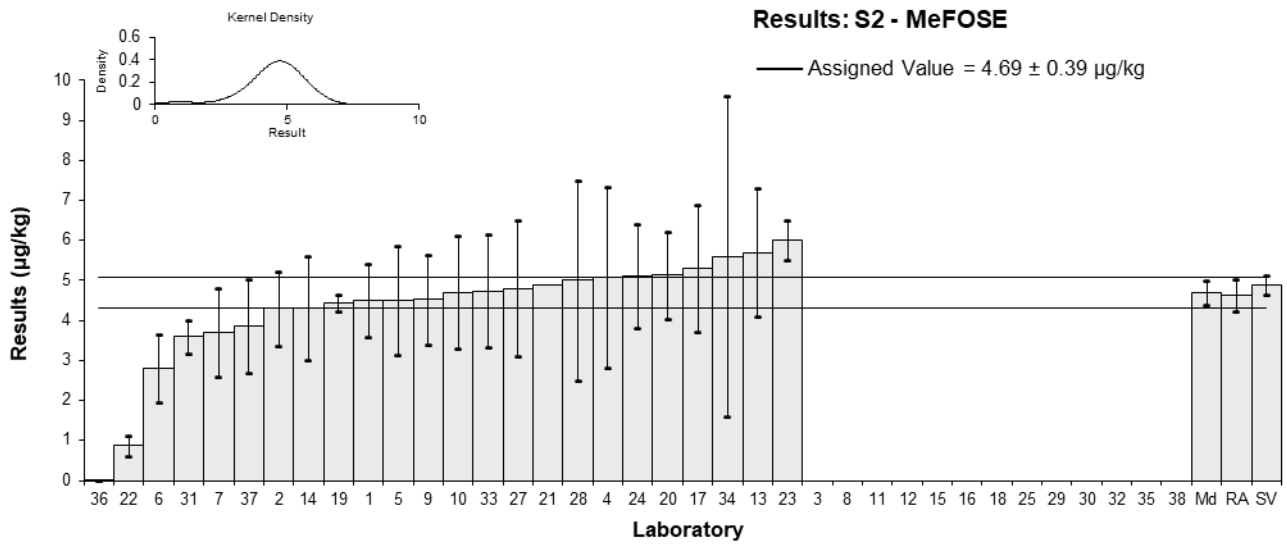
**Participant Results**

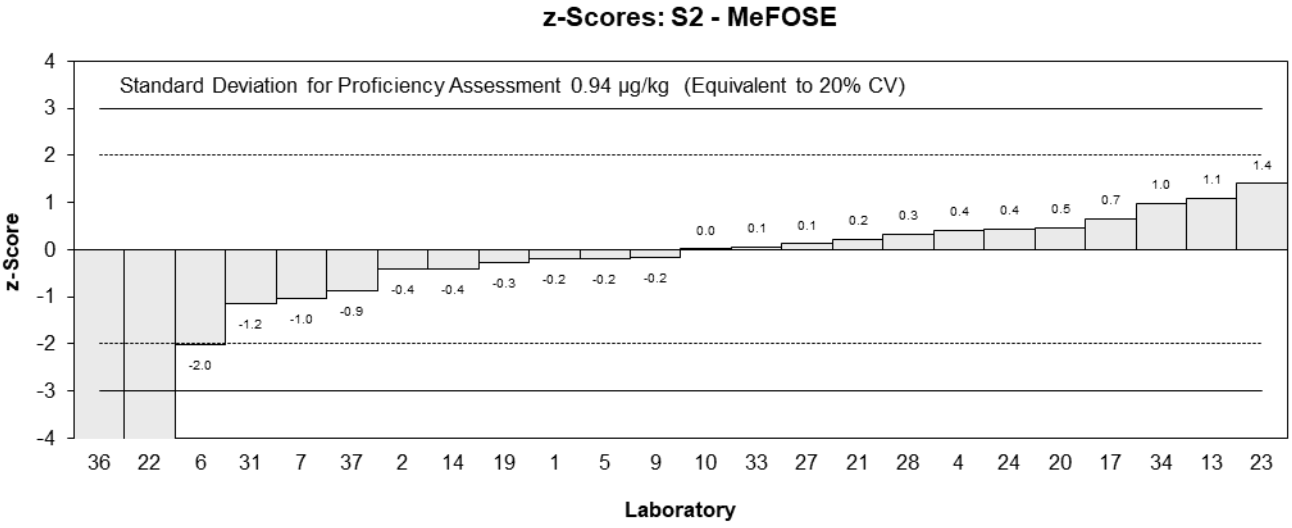
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 4.5 | 0.92 | 100 | -0.20 | -0.19 |
| **2** | 4.3 | 0.93 | NR | -0.42 | -0.39 |
| **3** | NT | NT | NT | | |
| **4** | 5.076 | 2.27 | 82 | 0.41 | 0.17 |
| **5** | 4.50378 | 1.351134 | 84 | -0.20 | -0.13 |
| **6** | 2.8 | 0.84 | 93 | -2.01 | -2.04 |
| **7** | 3.71 | 1.1 | NR | -1.04 | -0.84 |
| **8** | NT | NT | NT | | |
| **9** | 4.52 | 1.13 | 83 | -0.18 | -0.14 |
| **10** | 4.7 | 1.41 | 93.5 | 0.01 | 0.01 |
| **11** | NR | NR | NR | | |
| **12** | NR | NR | NR | | |
| **13** | 5.7 | 1.6 | 54 | 1.08 | 0.61 |
| **14** | 4.3 | 1.3 | 64 | -0.42 | -0.29 |
| **15** | NR | NR | NR | | |
| **16** | <50 | NR | NR | | |
| **17** | 5.306931 | 1.592079 | 78 | 0.66 | 0.38 |
| **18** | <5 | NR | NR | | |
| **19** | 4.43 | 0.202 | 49 | -0.28 | -0.59 |
| **20** | 5.13 | 1.1 | 88 | 0.47 | 0.38 |
| **21** | 4.9 | NR | 78 | 0.22 | 0.54 |
| **22*** | 0.87 | 0.261 | 93 | -4.07 | -8.14 |
| **23** | 6 | 0.49 | NR | 1.40 | 2.09 |
| **24** | 5.1 | 1.3 | 66.12 | 0.44 | 0.30 |
| **25** | <5 | NR | NR | | |
| **27** | 4.8 | 1.7 | NT | 0.12 | 0.06 |
| **28** | 5 | 2.5 | 91 | 0.33 | 0.12 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 3.6 | 0.42 | 75.65 | -1.16 | -1.90 |
| **32** | <1 | NR | NR | | |
| **33** | 4.739 | 1.42 | 76 | 0.05 | 0.03 |
| **34** | 5.6 | 4 | 82 | 0.97 | 0.23 |
| **35** | NT | NT | NT | | |
| **36**** | 0.00378 | 0.00038 | 100 | -5.00 | -12.02 |
| **37** | 3.86 | 1.158 | 107 | -0.88 | -0.68 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.69 | 0.39 |
| **Spike Value** | 4.90 | 0.24 |
| **Robust Average** | 4.63 | 0.41 |
| **Median** | 4.70 | 0.31 |
| **Mean** | 4.50 | |
| **N** | 23 | |
| **Max** | 6 | |
| **Min** | 0.87 | |
| **Robust SD** | 0.78 | |
| **Robust CV** | 17% | |


Kernel Density
Density
Result
Results: S2 - MeFOSE
Assigned Value = 4.69 ± 0.39 µg/kg
Results (µg/kg)
Laboratory
36 22 6 31 7 37 2 14 19 1 5 9 10 33 27 21 28 4 24 20 17 34 13 23 3 8 11 12 15 16 18 25 29 30 32 35 38 Md RA SV


z-Scores: S2 - MeFOSE
Standard Deviation for Proficiency Assessment 0.94 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 22 6 31 7 37 2 14 19 1 5 9 10 33 27 21 28 4 24 20 17 34 13 23

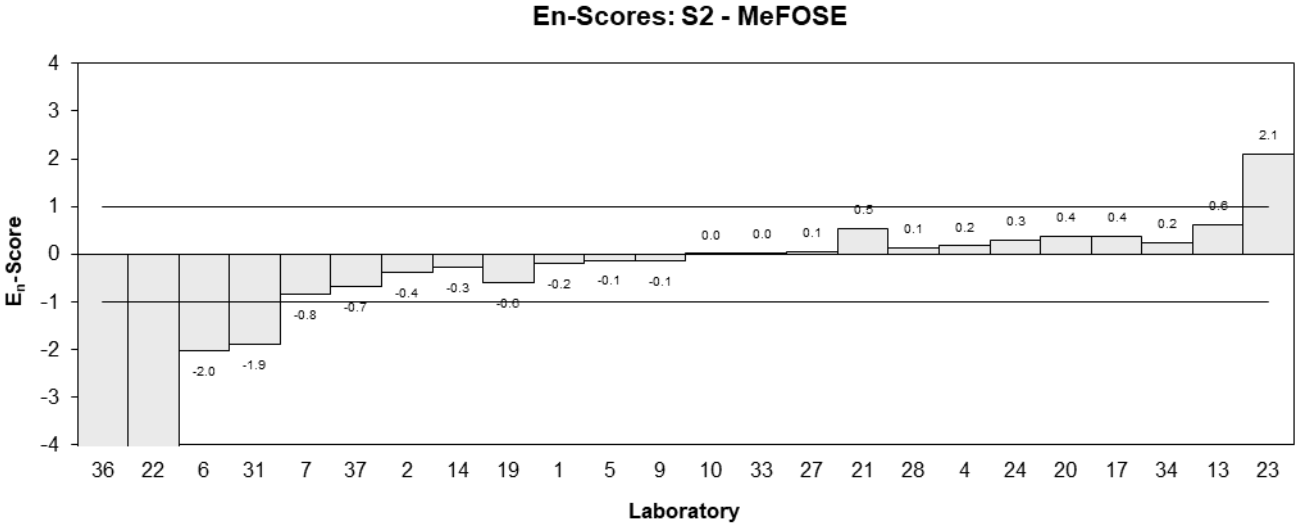

En-Scores: S2 - MeFOSE
En-Score
Laboratory
36 22 6 31 7 37 2 14 19 1 5 9 10 33 27 21 28 4 24 20 17 34 13 23

Figure 42

Table 46

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 6:2FTS |
| **Unit** | µg/kg |

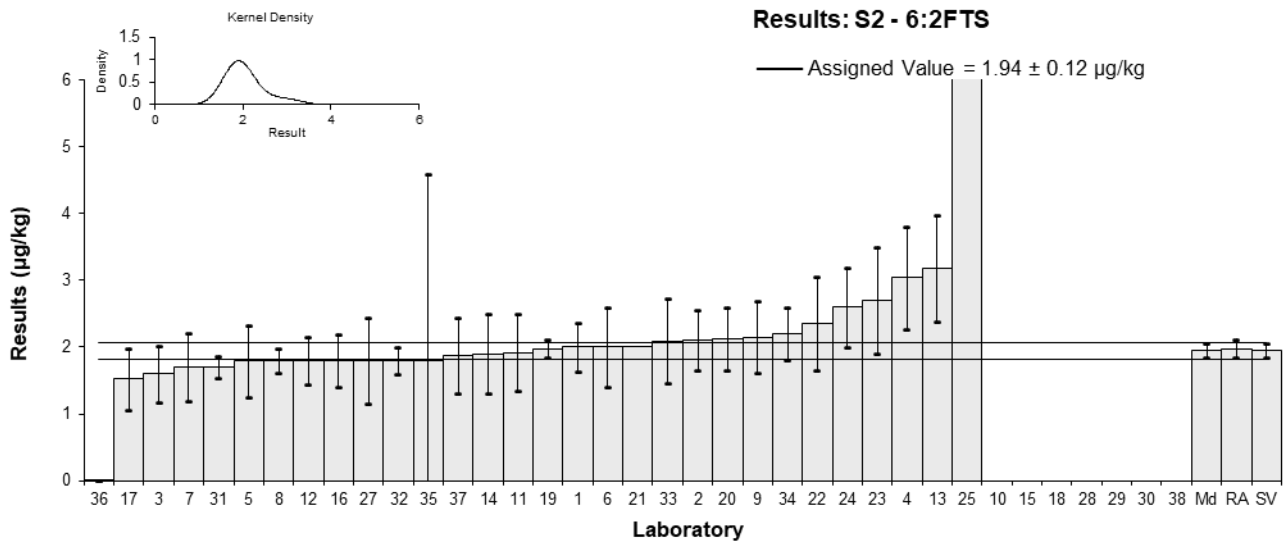
**Participant Results**

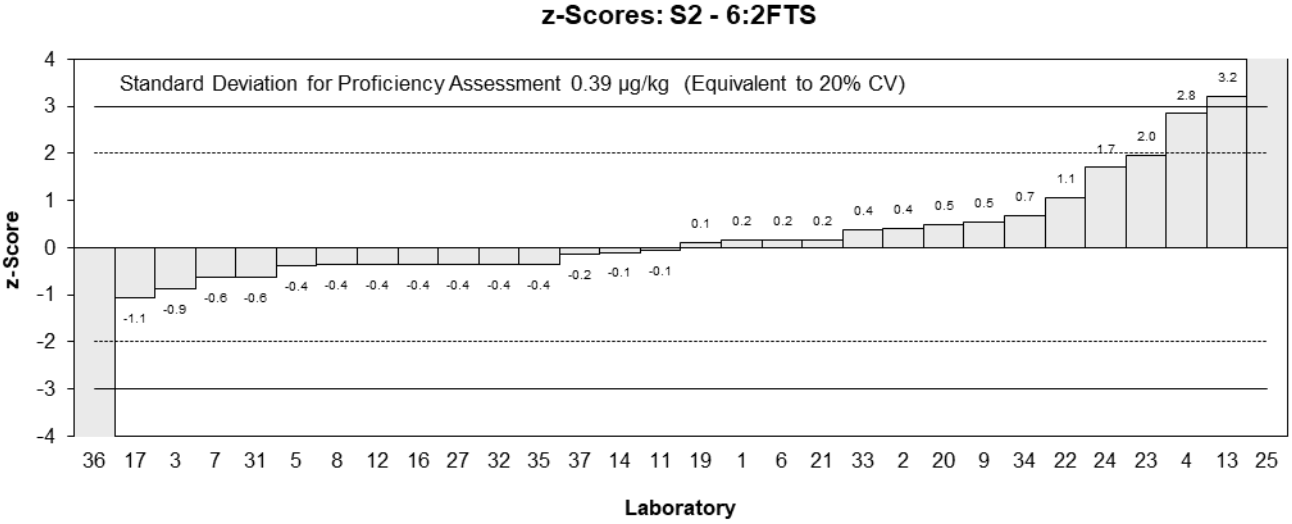
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.0 | 0.36 | 110 | 0.15 | 0.16 |
| **2** | 2.1 | 0.45 | NR | 0.41 | 0.34 |
| **3** | 1.597 | 0.431 | NR | -0.88 | -0.77 |
| **4*** | 3.041 | 0.77 | 95 | 2.84 | 1.41 |
| **5** | 1.79144 | 0.537432 | 122 | -0.38 | -0.27 |
| **6** | 2.0 | 0.6 | 94 | 0.15 | 0.10 |
| **7** | 1.7 | 0.51 | NR | -0.62 | -0.46 |
| **8** | 1.799503 | 0.17995 | >75 | -0.36 | -0.65 |
| **9** | 2.15 | 0.54 | 203 | 0.54 | 0.38 |
| **10** | <5 | NR | 110 | | |
| **11** | 1.918 | 0.5754 | 115 | -0.06 | -0.04 |
| **12** | 1.8 | 0.36 | 132 | -0.36 | -0.37 |
| **13*** | 3.18 | 0.79 | 91 | 3.20 | 1.55 |
| **14** | 1.9 | 0.6 | 90 | -0.10 | -0.07 |
| **15** | NR | NR | NR | | |
| **16** | 1.8 | 0.4 | NR | -0.36 | -0.34 |
| **17** | 1.523630 | 0.457089 | 192 | -1.07 | -0.88 |
| **18** | <5 | NR | NR | | |
| **19** | 1.98 | 0.131 | 86 | 0.10 | 0.23 |
| **20** | 2.13 | 0.47 | 323 | 0.49 | 0.39 |
| **21** | 2 | NR | 102 | 0.15 | 0.50 |
| **22** | 2.35 | 0.706 | 94 | 1.06 | 0.57 |
| **23** | 2.7 | 0.8 | 98 | 1.96 | 0.94 |
| **24** | 2.6 | 0.6 | 208.53 | 1.70 | 1.08 |
| **25**** | 65 | NR | NR | 162.53 | 525.50 |
| **27** | 1.8 | 0.65 | NT | -0.36 | -0.21 |
| **28** | < 20 | 10 | 109 | | |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 1.7 | 0.17 | 207.01 | -0.62 | -1.15 |
| **32** | 1.8 | 0.20 | NR | -0.36 | -0.60 |
| **33** | 2.092 | 0.63 | 128 | 0.39 | 0.24 |
| **34** | 2.2 | 0.4 | 154 | 0.67 | 0.62 |
| **35** | 1.8 | 2.8 | 103.4 | -0.36 | -0.05 |
| **36**** | 0.00176 | 0.00016 | 121 | -5.00 | -16.15 |
| **37** | 1.88 | 0.564 | 104 | -0.15 | -0.10 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.94 | 0.12 |
| **Spike Value** | 1.95 | 0.10 |
| **Robust Average** | 1.98 | 0.14 |
| **Median** | 1.95 | 0.11 |
| **Mean** | 2.05 | |
| **N** | 28 | |
| **Max** | 3.18 | |
| **Min** | 1.523630 | |
| **Robust SD** | 0.29 | |
| **Robust CV** | 15% | |


Results: S2 - 6:2FTS
Assigned Value = 1.94 ± 0.12 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
36 17 3 7 31 5 8 12 16 27 32 35 37 14 11 19 1 6 21 33 2 20 9 34 22 24 23 4 13 25 10 15 18 28 29 30 38 Md RA SV
Laboratory


z-Scores: S2 - 6:2FTS
Standard Deviation for Proficiency Assessment 0.39 µg/kg (Equivalent to 20% CV)
z-Score
36 17 3 7 31 5 8 12 16 27 32 35 37 14 11 19 1 6 21 33 2 20 9 34 22 24 23 4 13 25
Laboratory

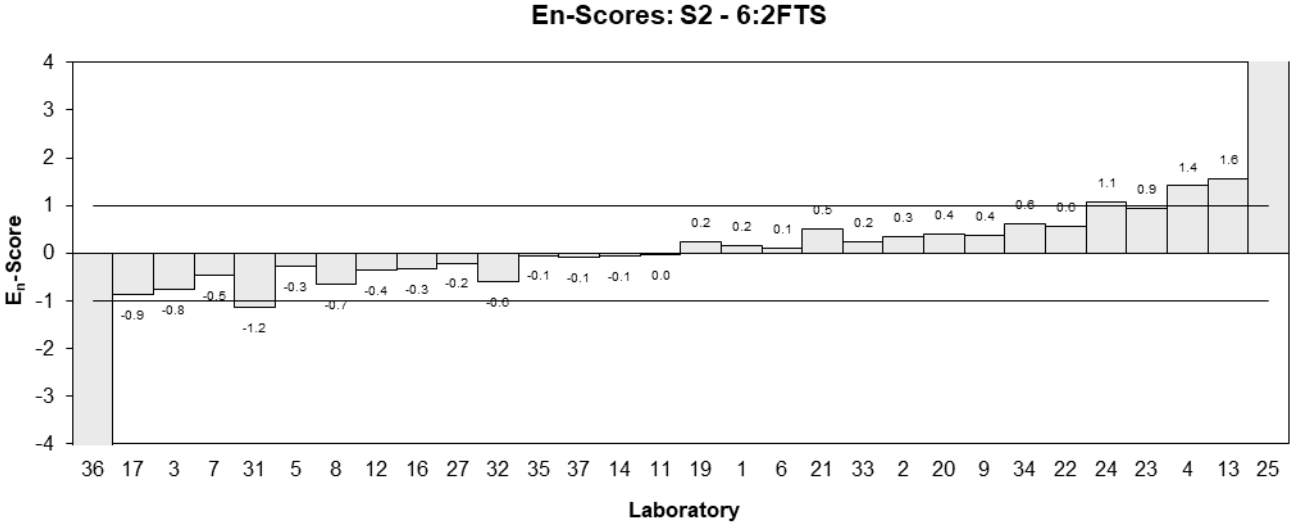

En-Scores: S2 - 6:2FTS
En-Score
36 17 3 7 31 5 8 12 16 27 32 35 37 14 11 19 1 6 21 33 2 20 9 34 22 24 23 4 13 25
Laboratory

Figure 43

Table 47

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 10:2FTS |
| **Unit** | µg/kg |

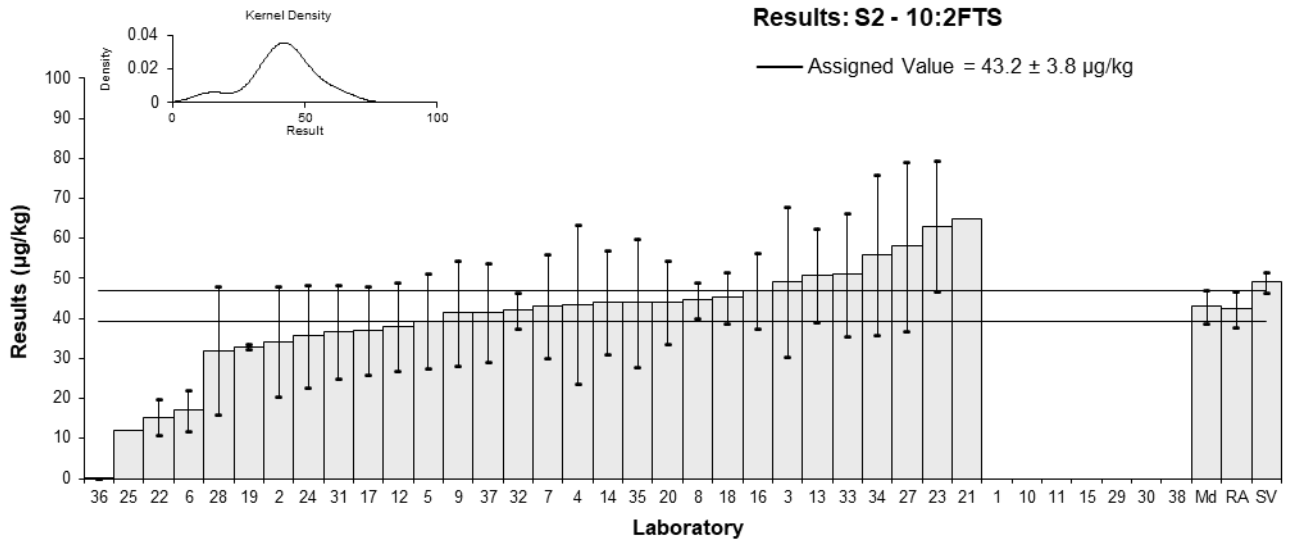
**Participant Results**

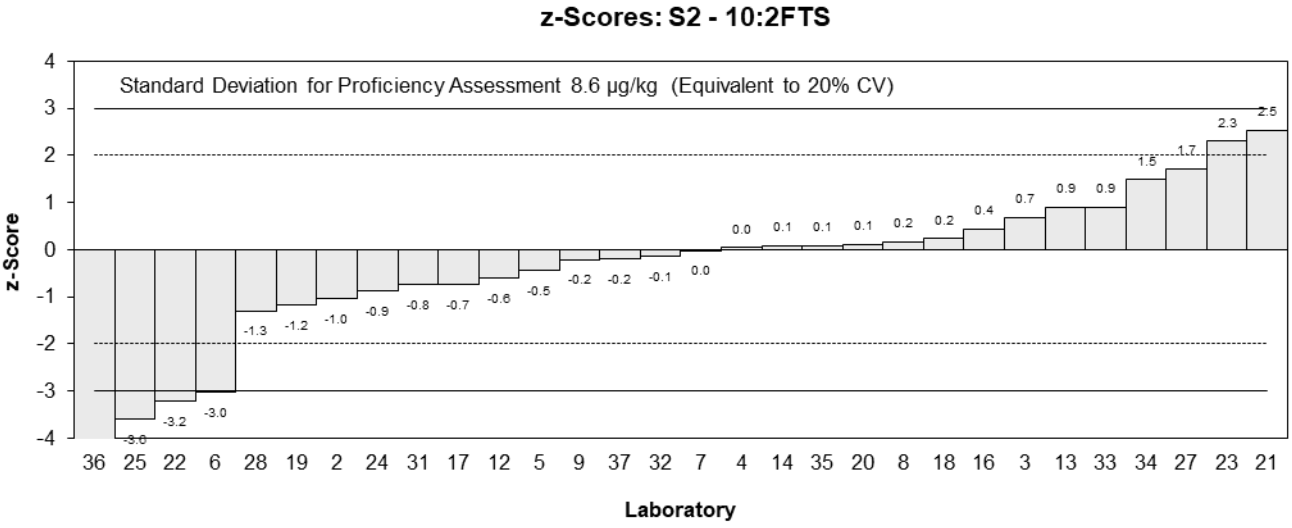
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | 34.2 | 13.8 | NR | -1.04 | -0.63 |
| **3** | 49.078 | 18.76 | NR | 0.68 | 0.31 |
| **4** | 43.565 | 19.86 | NR | 0.04 | 0.02 |
| **5** | 39.34482 | 11.80344 | 100 | -0.45 | -0.31 |
| **6*** | 17 | 5.1 | 72 | -3.03 | -4.12 |
| **7** | 43 | 13 | NR | -0.02 | -0.01 |
| **8** | 44.55901 | 4.45590 | >75 | 0.16 | 0.23 |
| **9** | 41.4 | 13.2 | 159 | -0.21 | -0.13 |
| **10** | NT | NT | NT | | |
| **11** | NR | NR | NR | | |
| **12** | 38 | 11 | NR | -0.60 | -0.45 |
| **13** | 50.88 | 11.7 | 74 | 0.89 | 0.62 |
| **14** | 44 | 13 | 97 | 0.09 | 0.06 |
| **15** | NR | NR | NR | | |
| **16** | 47 | 9.4 | NR | 0.44 | 0.37 |
| **17** | 36.89370 | 11.06811 | 357 | -0.73 | -0.54 |
| **18** | 45.2 | 6.3 | 198 | 0.23 | 0.27 |
| **19** | 33 | 0.787 | 73 | -1.18 | -2.63 |
| **20** | 44.1 | 10.3 | 219 | 0.10 | 0.08 |
| **21*** | 65 | NR | 118 | 2.52 | 5.74 |
| **22*** | 15.35 | 4.604 | 72 | -3.22 | -4.67 |
| **23** | 63.1 | 16.4 | NR | 2.30 | 1.18 |
| **24** | 35.6 | 12.7 | 253.29 | -0.88 | -0.57 |
| **25*** | 12 | NR | NR | -3.61 | -8.21 |
| **27** | 58 | 21 | NT | 1.71 | 0.69 |
| **28** | 32 | 16 | NR | -1.30 | -0.68 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 36.7 | 11.82 | 168.31 | -0.75 | -0.52 |
| **32** | 42 | 4.4 | NR | -0.14 | -0.21 |
| **33** | 51.008 | 15.30 | 62 | 0.90 | 0.50 |
| **34** | 56 | 20 | 116 | 1.48 | 0.63 |
| **35** | 44 | 16 | 88.6 | 0.09 | 0.05 |
| **36**** | 0.0481 | 0.0056 | 106 | -4.99 | -11.36 |
| **37** | 41.48 | 12.444 | 91 | -0.20 | -0.13 |
| **38** | NS | NS | NS | | |

* Outlier, ** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 43.2 | 3.8 |
| **Spike Value** | 49.1 | 2.5 |
| **Robust Average** | 42.3 | 4.6 |
| **Median** | 43.0 | 4.2 |
| **Mean** | 41.5 | |
| **N** | 29 | |
| **Max** | 65 | |
| **Min** | 12 | |
| **Robust SD** | 10 | |
| **Robust CV** | 24% | |


Kernel Density
Density
Result
Results: S2 - 10:2FTS
Assigned Value = 43.2 ± 3.8 µg/kg
Results (µg/kg)
Laboratory
36 25 22 6 28 19 2 24 31 17 12 5 9 37 32 7 4 14 35 20 8 18 16 3 13 33 34 27 23 21 1 10 11 15 29 30 38 Md RA SV


z-Scores: S2 - 10:2FTS
Standard Deviation for Proficiency Assessment 8.6 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 25 22 6 28 19 2 24 31 17 12 5 9 37 32 7 4 14 35 20 8 18 16 3 13 33 34 27 23 21

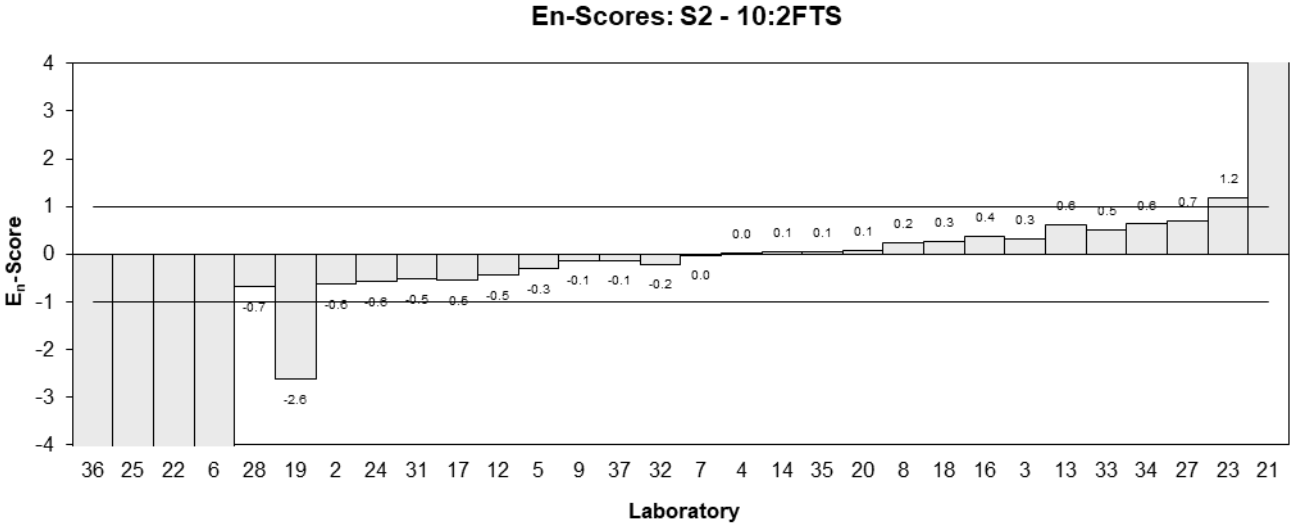

En-Scores: S2 - 10:2FTS
En-Score
Laboratory
36 25 22 6 28 19 2 24 31 17 12 5 9 37 32 7 4 14 35 20 8 18 16 3 13 33 34 27 23 21

Figure 44

Table 48

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 8:2diPAP |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | 2.2 | 1.14 | NR |
| **3** | 2.345 | 0.582 | NR |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | 1.943908 | 0.19439 | >75 |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | NR | NR | NR |
| **12** | NR | NR | NR |
| **13** | <2 | NR | NR |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 2.15 | 0.482 | 64 |
| **20** | 2.43 | NR | 35 |
| **21** | 5 | NR | 167 |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | 2.9 | 0.6 | 149.65 |
| **25** | NT | NT | NT |
| **27** | 1.0 | 0.36 | NT |
| **28** | 2 | 1 | NR |
| **29** | 1.421 | 0.568 | NR |
| **30** | NS | NS | NS |
| **31** | 1.2 | NR | 63.19 |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | 1.9 | 0.59 | 112.8 |
| **36** | NT | NT | NT |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 4.90 | 0.24 |
| **Robust Average** | 2.05 | 0.52 |
| **Median** | 2.08 | 0.33 |
| **Mean** | 2.21 | |
| **N** | 12 | |
| **Max** | 5 | |
| **Min** | 1 | |
| **Robust SD** | 0.72 | |
| **Robust CV** | 35% | |

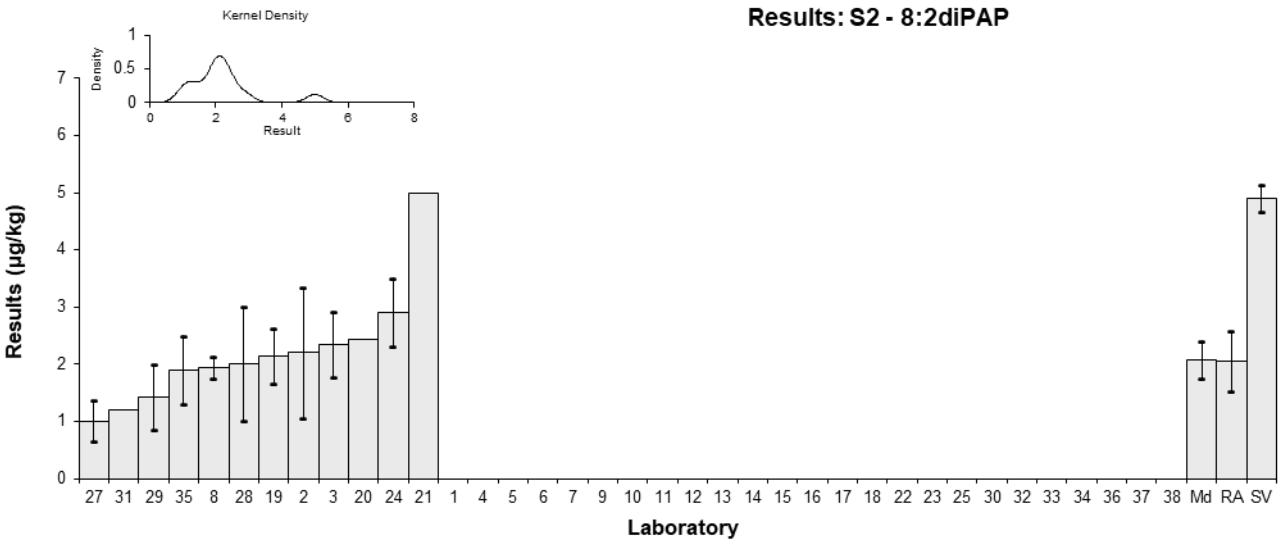

Results: S2 - 8:2diPAP
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
27 31 29 35 8 28 19 2 3 20 24 21 1 4 5 6 7 9 10 11 12 13 14 15 16 17 18 22 23 25 30 32 33 34 36 37 38 Md RA SV

Figure 45

Table 49

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 6:2FTOH |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NT | NT | NT |
| **3** | NT | NT | NT |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | NT | NT | NT |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | NR | NR | NR |
| **12** | NT | NT | NT |
| **13** | NT | NT | NT |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | NT | NT | NT |
| **20** | 2.75 | NR | 117 |
| **21** | <10 | NR | NR |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | <5 | 2 | NT |
| **28** | NT | NT | NT |
| **29** | 2.079 | 0.624 | NR |
| **30** | NS | NS | NS |
| **31** | NR | NR | NR |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | NT | NT | NT |
| **36** | NT | NT | NT |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 9.80 | 0.49 |
| **Robust Average** | NA (N<6) | |
| **Median** | NA (N<3) | |
| **Mean** | 2.41 | |
| **N** | 2 | |
| **Max** | 2.75 | |
| **Min** | 2.079 | |
| **Robust SD** | NA (N<6) | |
| **Robust CV** | NA (N<6) | |

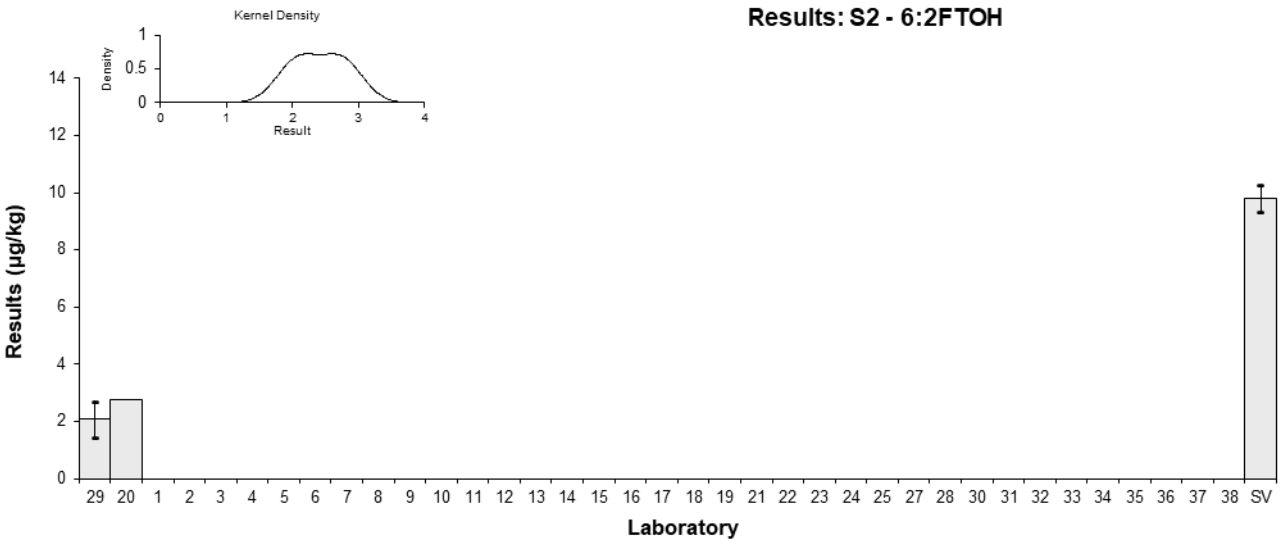

Results: S2 - 6:2FTOH
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
29 20 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 21 22 23 24 25 27 28 30 31 32 33 34 35 36 37 38 SV

Figure 46

Table 50

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 3:3FTCA |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | 21 | 3.6 | 104 |
| **2** | 15.8 | 4.65 | NR |
| **3** | NT | NT | NT |
| **4** | NR | NR | NR |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | 1.7 | 0.51 | NR |
| **8** | NT | NT | NT |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | NR | NR | NR |
| **12** | 61 | 12 | NR |
| **13** | 15.26 | 3.51 | NR |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 14.1 | 2.1 | 79 |
| **20** | 18.7 | NR | 121 |
| **21** | 18 | NR | NR |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | 22.2 | 4.4 | 69.31 |
| **25** | NT | NT | NT |
| **27** | NT | NT | NT |
| **28** | 11 | 5.5 | NR |
| **29** | NT | NT | NT |
| **30** | NS | NS | NS |
| **31** | 13 | NR | 75.56 |
| **32** | 15 | 1.7 | NR |
| **33** | 13.724 | 4.12 | NR |
| **34** | 16 | 4 | 101 |
| **35** | NT | NT | NT |
| **36**** | 0.0169 | 0.0026 | 95 |
| **37** | NT | NT | NT |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 34.3 | 1.7 |
| **Robust Average** | 16.1 | 3.1 |
| **Median** | 15.5 | 2.5 |
| **Mean** | 18.3 | |
| **N** | 14 | |
| **Max** | 61 | |
| **Min** | 1.7 | |
| **Robust SD** | 4.6 | |
| **Robust CV** | 28% | |

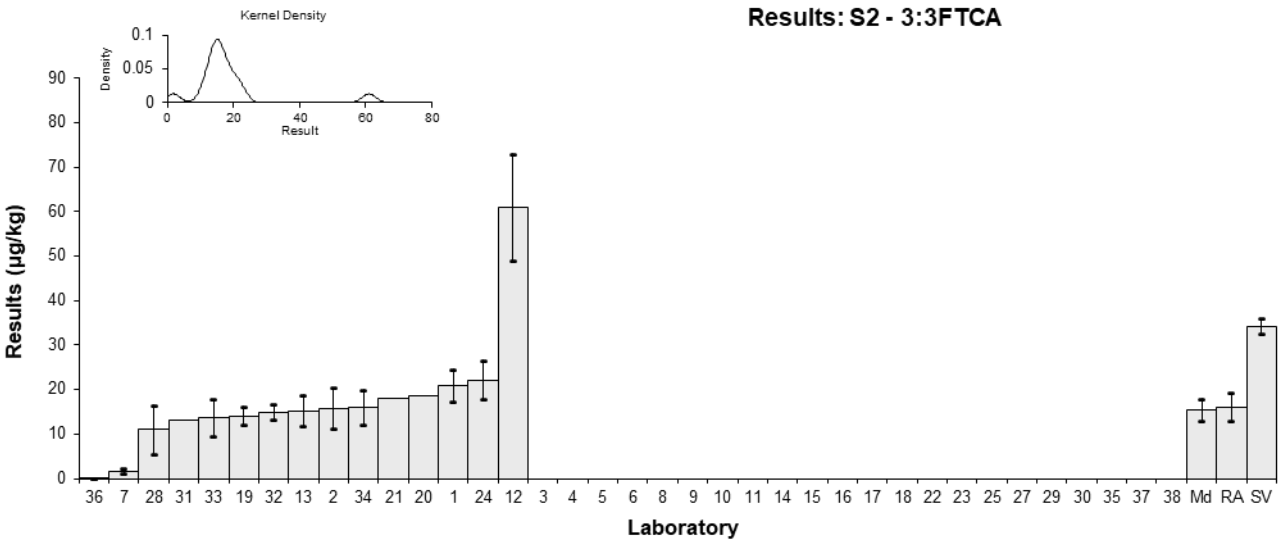

Results: S2 - 3:3FTCA
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 7 28 31 33 19 32 13 2 34 21 20 1 24 12 3 4 5 6 8 9 10 11 14 15 16 17 18 22 23 25 27 29 30 35 37 38 Md RA SV

Figure 47

Table 51

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | GenX |
| **Unit** | µg/kg |

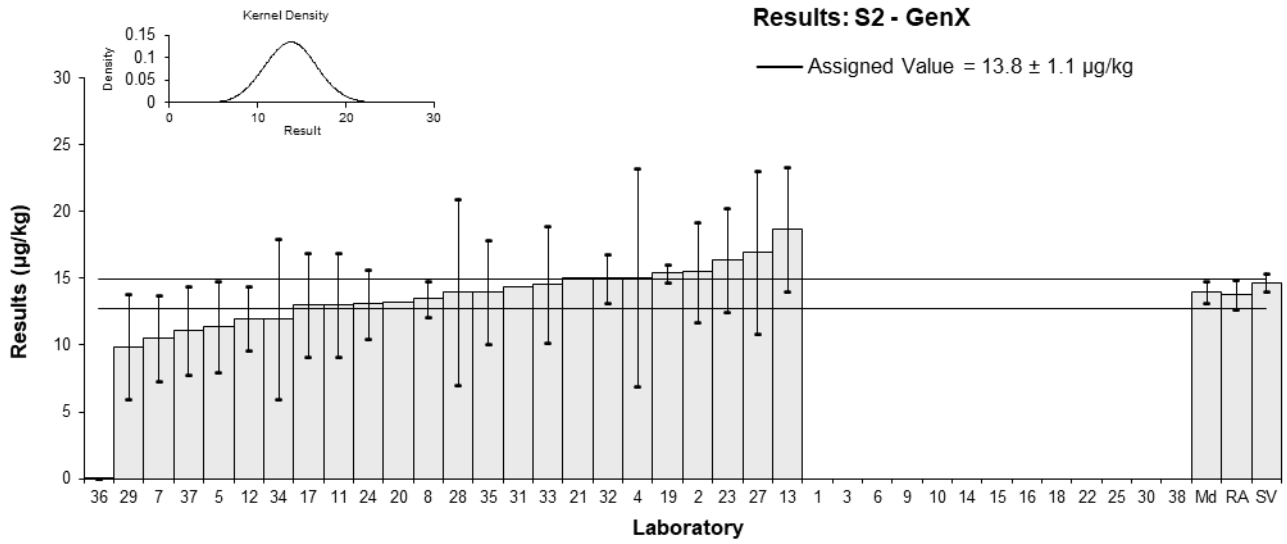
**Participant Results**

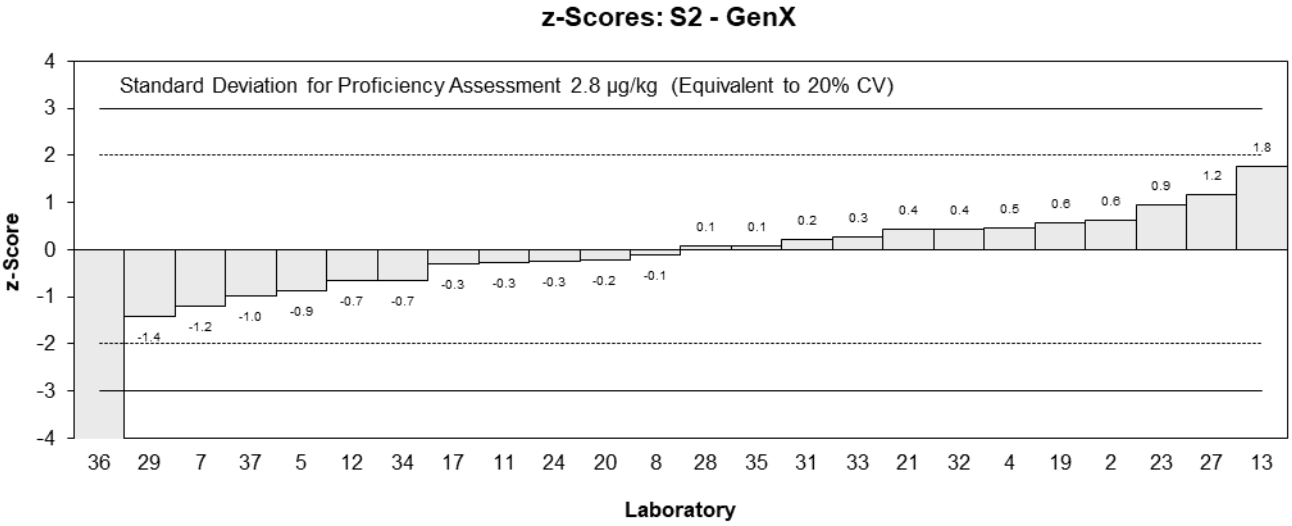
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | 15.5 | 3.73 | NR | 0.62 | 0.44 |
| **3** | NT | NT | NT | | |
| **4** | 15.087 | 8.16 | 103 | 0.47 | 0.16 |
| **5** | 11.364 | 3.4092 | 93 | -0.88 | -0.68 |
| **6** | NT | NT | NT | | |
| **7** | 10.5 | 3.2 | NR | -1.20 | -0.98 |
| **8** | 13.48335 | 1.34834 | >75 | -0.11 | -0.18 |
| **9** | NT | NT | NT | | |
| **10** | <1 | NR | 95.5 | | |
| **11** | 12.999 | 3.8997 | 51.8 | -0.29 | -0.20 |
| **12** | 12 | 2.4 | 103 | -0.65 | -0.68 |
| **13** | 18.66 | 4.67 | 116 | 1.76 | 1.01 |
| **14** | NT | NT | NT | | |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | 12.97902 | 3.893707 | 100 | -0.30 | -0.20 |
| **18** | NT | NT | NT | | |
| **19** | 15.4 | 0.652 | 76 | 0.58 | 1.25 |
| **20** | 13.2 | NR | 133 | -0.22 | -0.55 |
| **21** | 15 | NR | 95 | 0.43 | 1.09 |
| **22** | NT | NT | NT | | |
| **23** | 16.4 | 3.9 | 84 | 0.94 | 0.64 |
| **24** | 13.1 | 2.6 | 94.3 | -0.25 | -0.25 |
| **25** | NT | NT | NT | | |
| **27** | 17 | 6.1 | NT | 1.16 | 0.52 |
| **28** | 14 | 7 | NR | 0.07 | 0.03 |
| **29** | 9.878 | 3.951 | NR | -1.42 | -0.96 |
| **30** | NS | NS | NS | | |
| **31** | 14.4 | NR | 79.42 | 0.22 | 0.55 |
| **32** | 15 | 1.8 | NR | 0.43 | 0.57 |
| **33** | 14.537 | 4.36 | 67 | 0.27 | 0.16 |
| **34** | 12 | 6 | 114 | -0.65 | -0.30 |
| **35** | 14 | 3.9 | 86.0 | 0.07 | 0.05 |
| **36**** | 0.0125 | 0.0015 | 100 | -5.00 | -12.53 |
| **37** | 11.1 | 3.33 | 109 | -0.98 | -0.77 |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 13.8 | 1.1 |
| **Spike Value** | 14.7 | 0.7 |
| **Robust Average** | 13.8 | 1.1 |
| **Median** | 14.0 | 0.8 |
| **Mean** | 13.8 | |
| **N** | 23 | |
| **Max** | 18.66 | |
| **Min** | 9.878 | |
| **Robust SD** | 2.2 | |
| **Robust CV** | 16% | |


Results: S2 - GenX
Assigned Value = 13.8 ± 1.1 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
36 29 7 37 5 12 34 17 11 24 20 8 28 35 31 33 21 32 4 19 2 23 27 13 1 3 6 9 10 14 15 16 18 22 25 30 38 Md RA SV
Laboratory


z-Scores: S2 - GenX
Standard Deviation for Proficiency Assessment 2.8 µg/kg (Equivalent to 20% CV)
z-Score
36 29 7 37 5 12 34 17 11 24 20 8 28 35 31 33 21 32 4 19 2 23 27 13
Laboratory

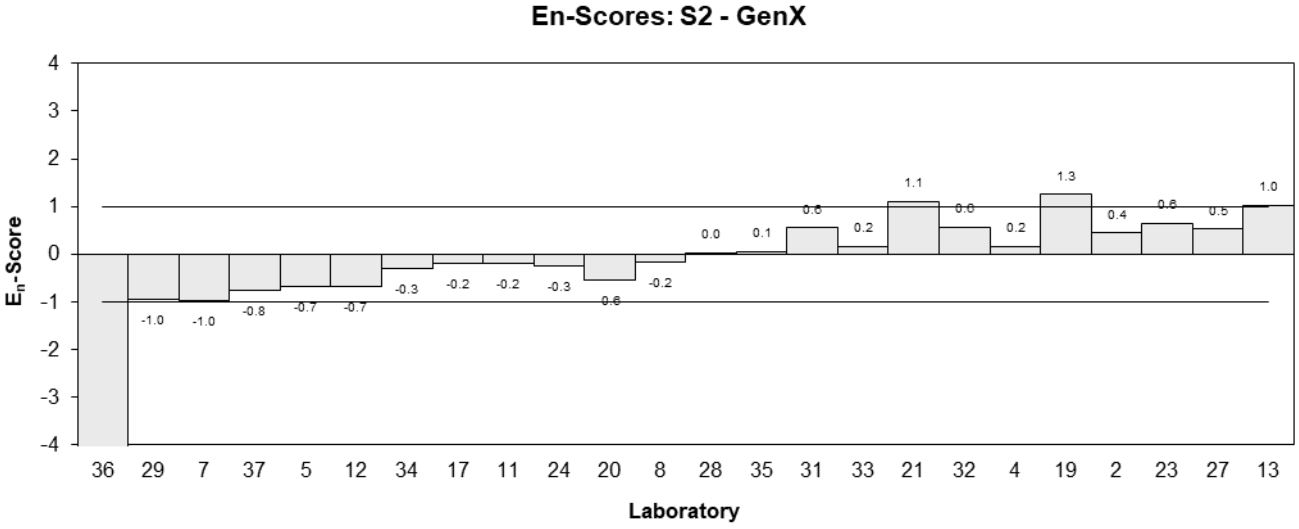

En-Scores: S2 - GenX
En-Score
36 29 7 37 5 12 34 17 11 24 20 8 28 35 31 33 21 32 4 19 2 23 27 13
Laboratory

Figure 48

Table 52

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFMPA |
| **Unit** | µg/kg |

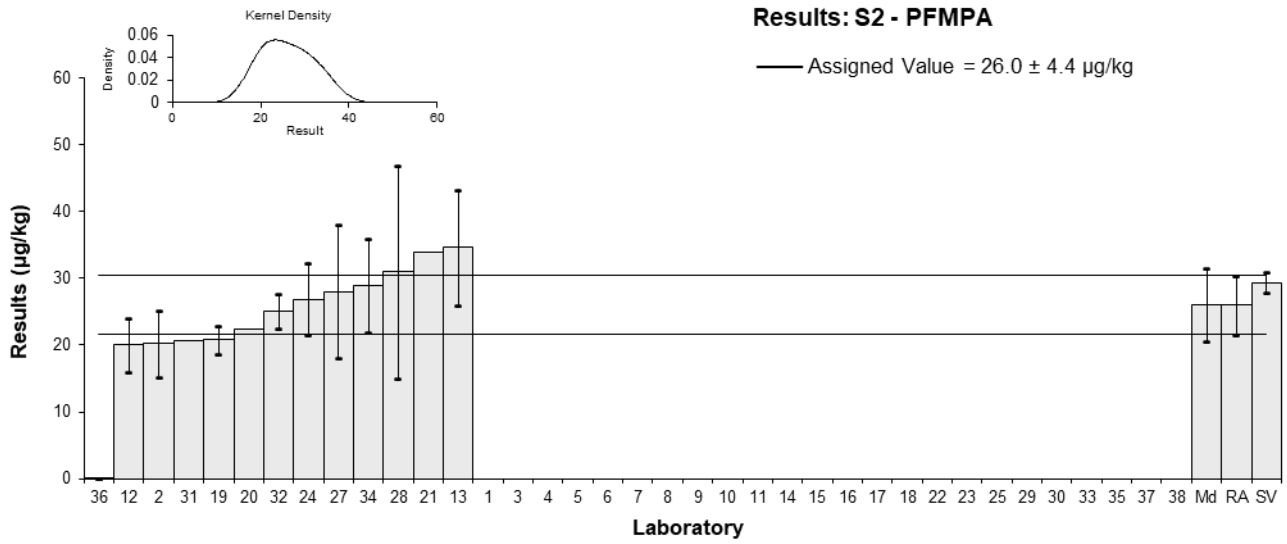
**Participant Results**

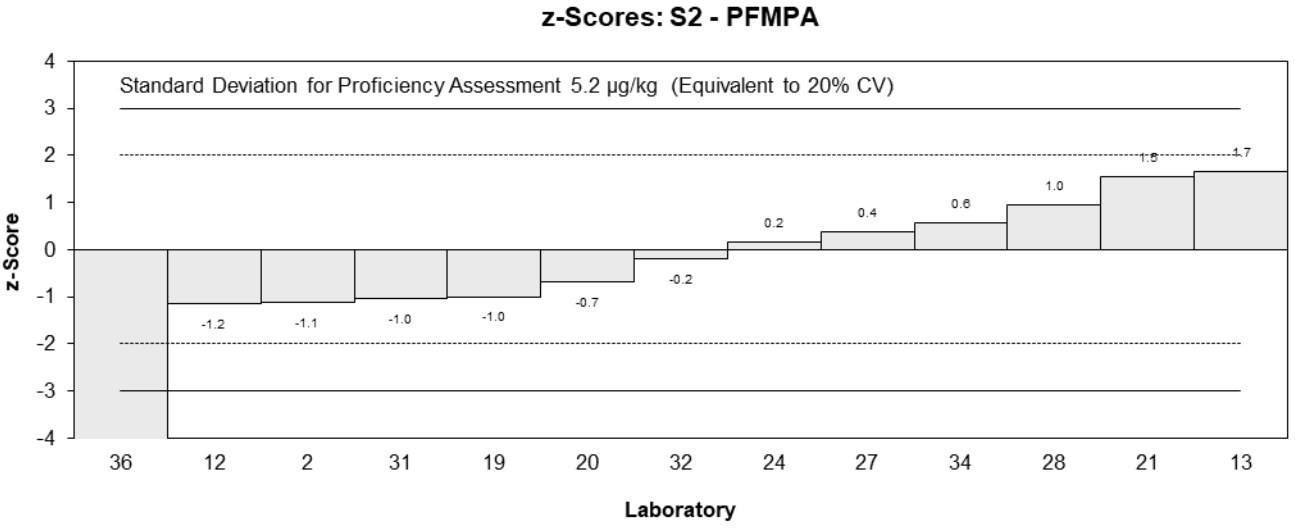
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NT | NT | NT | | |
| **2** | 20.2 | 4.93 | NR | -1.12 | -0.88 |
| **3** | NT | NT | NT | | |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | NT | NT | NT | | |
| **8** | NT | NT | NT | | |
| **9** | NT | NT | NT | | |
| **10** | NT | NT | NT | | |
| **11** | NR | NR | NR | | |
| **12** | 20 | 4.0 | NR | -1.15 | -1.01 |
| **13** | 34.63 | 8.66 | NR | 1.66 | 0.89 |
| **14** | NT | NT | NT | | |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 20.8 | 2.11 | 79 | -1.00 | -1.07 |
| **20** | 22.4 | NR | 125 | -0.69 | -0.82 |
| **21** | 34 | NR | NR | 1.54 | 1.82 |
| **22** | NT | NT | NT | | |
| **23** | NT | NT | NT | | |
| **24** | 26.9 | 5.4 | 84.41 | 0.17 | 0.13 |
| **25** | NT | NT | NT | | |
| **27** | 28 | 10 | NT | 0.38 | 0.18 |
| **28** | 31 | 16 | NR | 0.96 | 0.30 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 20.6 | NR | 75.56 | -1.04 | -1.23 |
| **32** | 25 | 2.6 | NR | -0.19 | -0.20 |
| **33** | NT | NT | NT | | |
| **34** | 29 | 7 | 99 | 0.58 | 0.36 |
| **35** | NT | NT | NT | | |
| **36**** | 0.0282 | 0.0030 | 95 | -4.99 | -5.90 |
| **37** | NT | NT | NT | | |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 26.0 | 4.4 |
| **Spike Value** | 29.4 | 1.5 |
| **Robust Average** | 26.0 | 4.4 |
| **Median** | 26.0 | 5.5 |
| **Mean** | 26.0 | |
| **N** | 12 | |
| **Max** | 34.63 | |
| **Min** | 20 | |
| **Robust SD** | 6.1 | |
| **Robust CV** | 23% | |


Results: S2 - PFMPA
Assigned Value = 26.0 ± 4.4 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 12 2 31 19 20 32 24 27 34 28 21 13 1 3 4 5 6 7 8 9 10 11 14 15 16 17 18 22 23 25 29 30 33 35 37 38 Md RA SV


z-Scores: S2 - PFMPA
Standard Deviation for Proficiency Assessment 5.2 µg/kg (Equivalent to 20% CV)
z-Score
-1.2 -1.1 -1.0 -1.0 -0.7 -0.2 0.2 0.4 0.6 1.0 1.5 1.7
Laboratory
36 12 2 31 19 20 32 24 27 34 28 21 13

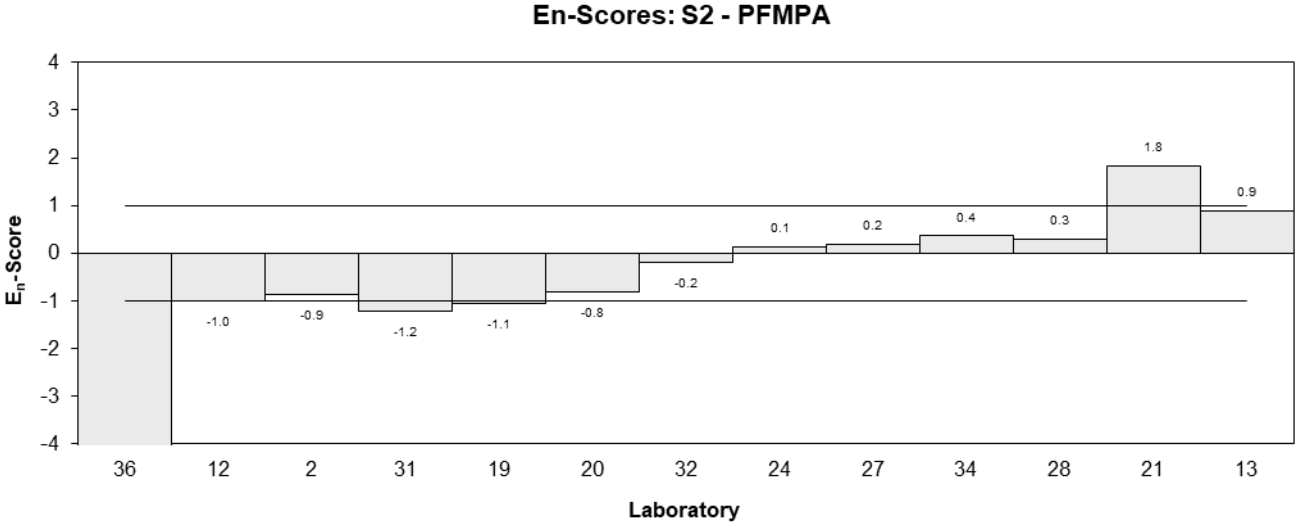

En-Scores: S2 - PFMPA
En-Score
-1.0 -0.9 -1.2 -1.1 -0.8 -0.2 0.1 0.2 0.4 0.3 1.8 0.9
Laboratory
36 12 2 31 19 20 32 24 27 34 28 21 13

Figure 49

Table 53

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | 11Cl-PF3OUdS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NR | NR | NR |
| **2** | 2.4 | 1.08 | NR |
| **3** | NT | NT | NT |
| **4** | 2.11 | 0.98 | NR |
| **5** | 2.31864 | 0.695592 | 109 |
| **6** | NT | NT | NT |
| **7** | 1.9 | 0.57 | NR |
| **8** | NT | NT | NT |
| **9** | NT | NT | NT |
| **10** | NT | NT | NT |
| **11** | 2.51 | 0.8785 | 91 |
| **12** | 2.2 | 0.44 | NR |
| **13** | <2 | NR | NR |
| **14** | NT | NT | NT |
| **15** | NR | NR | NR |
| **16** | NT | NT | NT |
| **17** | 1.940443 | 0.582133 | 122 |
| **18** | NT | NT | NT |
| **19** | 1.99 | 0.605 | 91 |
| **20** | 1.44 | NR | 148 |
| **21** | <10 | NR | NR |
| **22** | NT | NT | NT |
| **23** | 2.9 | NR | NR |
| **24** | 2.2 | 0.4 | 95.52 |
| **25** | NT | NT | NT |
| **27** | 2.5 | 0.90 | NT |
| **28** | 3 | 1.5 | NR |
| **29** | 1.249 | 0.499 | NR |
| **30** | NS | NS | NS |
| **31** | 2.5 | NR | 85.22 |
| **32** | 2.0 | 0.22 | NR |
| **33** | 2.995 | 0.90 | NR |
| **34** | 2.5 | 0.6 | 89 |
| **35** | 2.2 | 0.55 | 74.3 |
| **36**** | 0.00208 | 0.00023 | 100 |
| **37** | 2.01 | 0.603 | 91 |
| **38** | NS | NS | NS |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 4.92 | 0.25 |
| **Robust Average** | 2.26 | 0.25 |
| **Median** | 2.20 | 0.23 |
| **Mean** | 2.24 | |
| **N** | 20 | |
| **Max** | 3 | |
| **Min** | 1.249 | |
| **Robust SD** | 0.44 | |
| **Robust CV** | 20% | |

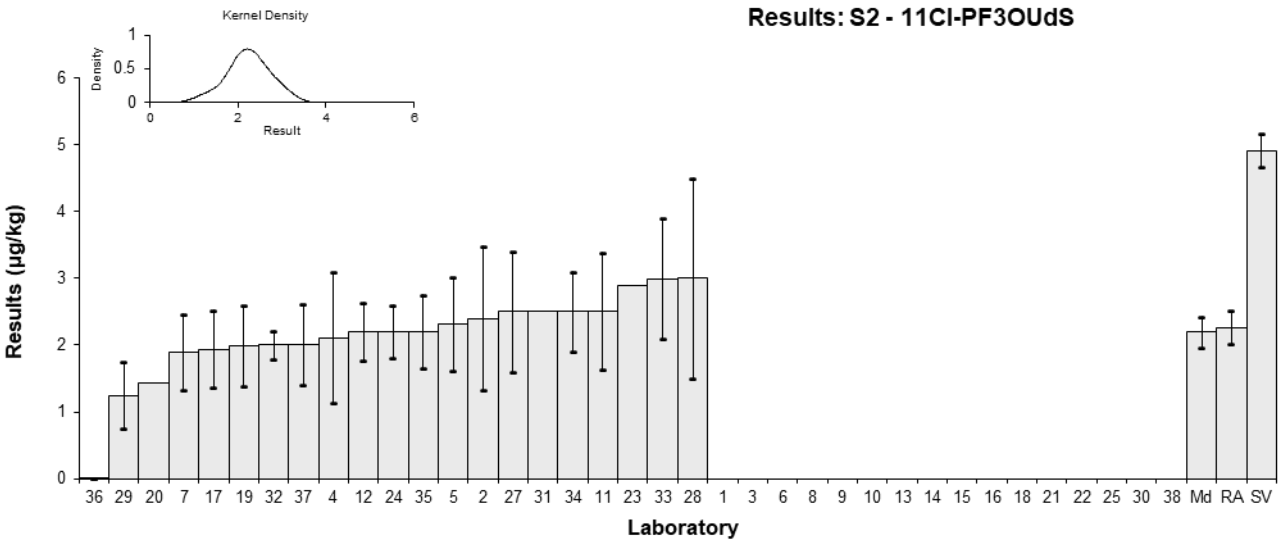

Results: S2 - 11Cl-PF3OUdS
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 29 20 7 17 19 32 37 4 12 24 35 5 2 27 31 34 11 23 33 28 1 3 6 8 9 10 13 14 15 16 18 21 22 25 30 38 Md RA SV

Figure 50

Table 54

**Sample Details**

| | |
|---|---|
| **Sample No.** | S2 |
| **Matrix** | Soil |
| **Analyte** | PFEESA |
| **Unit** | µg/kg |

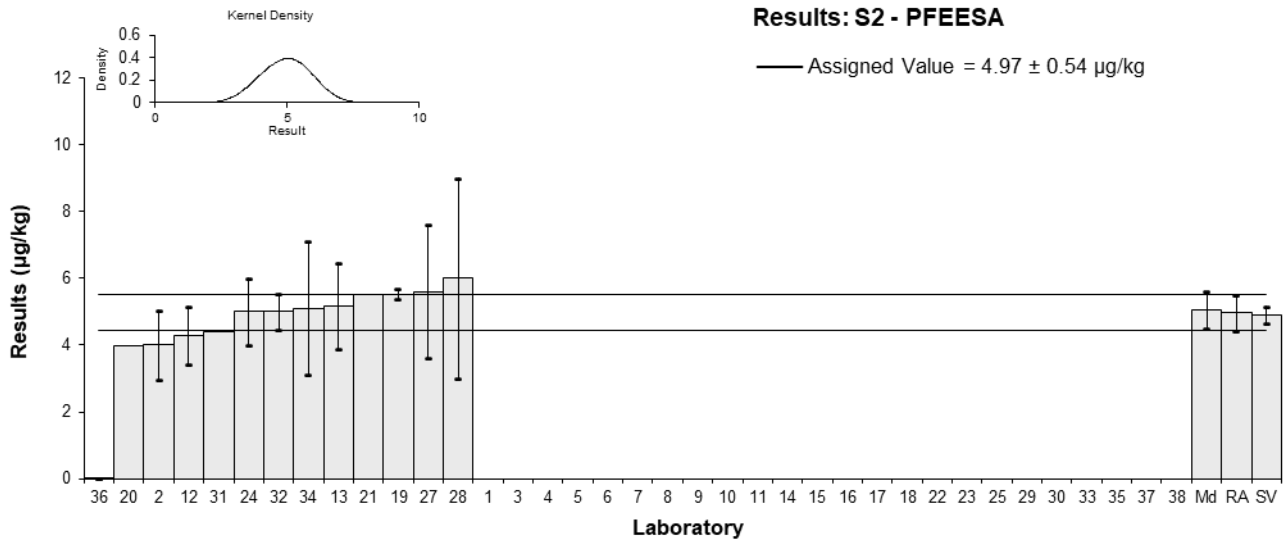
**Participant Results**

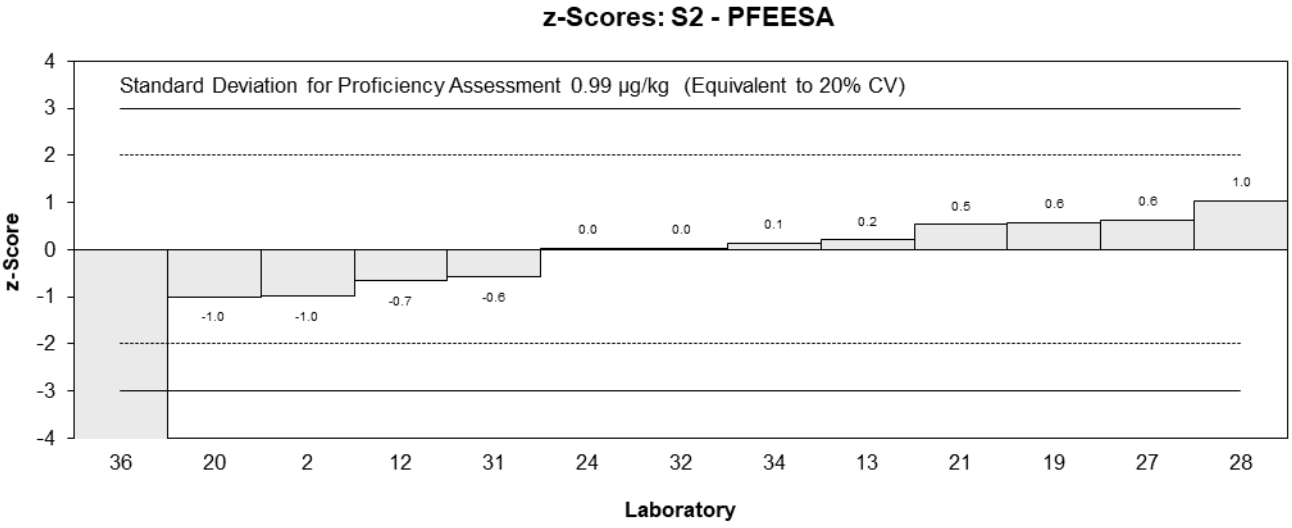
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NT | NT | NT | | |
| **2** | 4 | 1.05 | NR | -0.98 | -0.82 |
| **3** | NT | NT | NT | | |
| **4** | NR | NR | NR | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | NT | NT | NT | | |
| **8** | NT | NT | NT | | |
| **9** | NT | NT | NT | | |
| **10** | NT | NT | NT | | |
| **11** | NR | NR | NR | | |
| **12** | 4.3 | 0.86 | NR | -0.67 | -0.66 |
| **13** | 5.17 | 1.29 | NR | 0.20 | 0.14 |
| **14** | NT | NT | NT | | |
| **15** | NR | NR | NR | | |
| **16** | NT | NT | NT | | |
| **17** | NR | NR | NR | | |
| **18** | NT | NT | NT | | |
| **19** | 5.53 | 0.155 | 81 | 0.56 | 1.00 |
| **20** | 3.98 | NR | 136 | -1.00 | -1.83 |
| **21** | 5.5 | NR | NR | 0.53 | 0.98 |
| **22** | NT | NT | NT | | |
| **23** | NT | NT | NT | | |
| **24** | 5.0 | 1.0 | 79.53 | 0.03 | 0.03 |
| **25** | NT | NT | NT | | |
| **27** | 5.6 | 2.0 | NT | 0.63 | 0.30 |
| **28** | 6 | 3 | NR | 1.04 | 0.34 |
| **29** | NT | NT | NT | | |
| **30** | NS | NS | NS | | |
| **31** | 4.4 | NR | 91.36 | -0.57 | -1.06 |
| **32** | 5.0 | 0.55 | NR | 0.03 | 0.04 |
| **33** | NT | NT | NT | | |
| **34** | 5.1 | 2 | 108 | 0.13 | 0.06 |
| **35** | NT | NT | NT | | |
| **36**** | 0.00472 | 0.00048 | 100 | -5.00 | -9.19 |
| **37** | NT | NT | NT | | |
| **38** | NS | NS | NS | | |

** Extreme Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.97 | 0.54 |
| **Spike Value** | 4.91 | 0.25 |
| **Robust Average** | 4.97 | 0.54 |
| **Median** | 5.05 | 0.55 |
| **Mean** | 4.97 | |
| **N** | 12 | |
| **Max** | 6 | |
| **Min** | 3.98 | |
| **Robust SD** | 0.75 | |
| **Robust CV** | 15% | |


Results: S2 - PFEESA
Assigned Value = 4.97 ± 0.54 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
36 20 2 12 31 24 32 34 13 21 19 27 28 1 3 4 5 6 7 8 9 10 11 14 15 16 17 18 22 23 25 29 30 33 35 37 38 Md RA SV


z-Scores: S2 - PFEESA
Standard Deviation for Proficiency Assessment 0.99 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
36 20 2 12 31 24 32 34 13 21 19 27 28
-1.0 -1.0 -0.7 -0.6 0.0 0.0 0.1 0.2 0.5 0.6 0.6 1.0

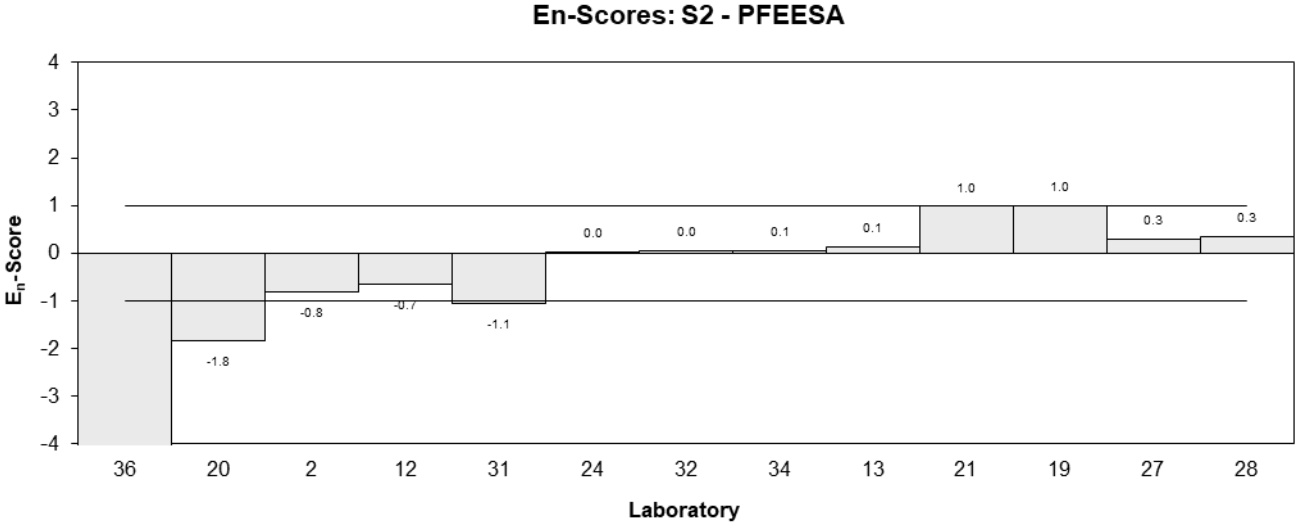

En-Scores: S2 - PFEESA
En-Score
Laboratory
36 20 2 12 31 24 32 34 13 21 19 27 28
-1.8 -0.8 -0.7 -1.1 0.0 0.0 0.1 0.1 1.0 1.0 0.3 0.3

Figure 51

Table 55

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFBA |
| **Unit** | µg/kg |

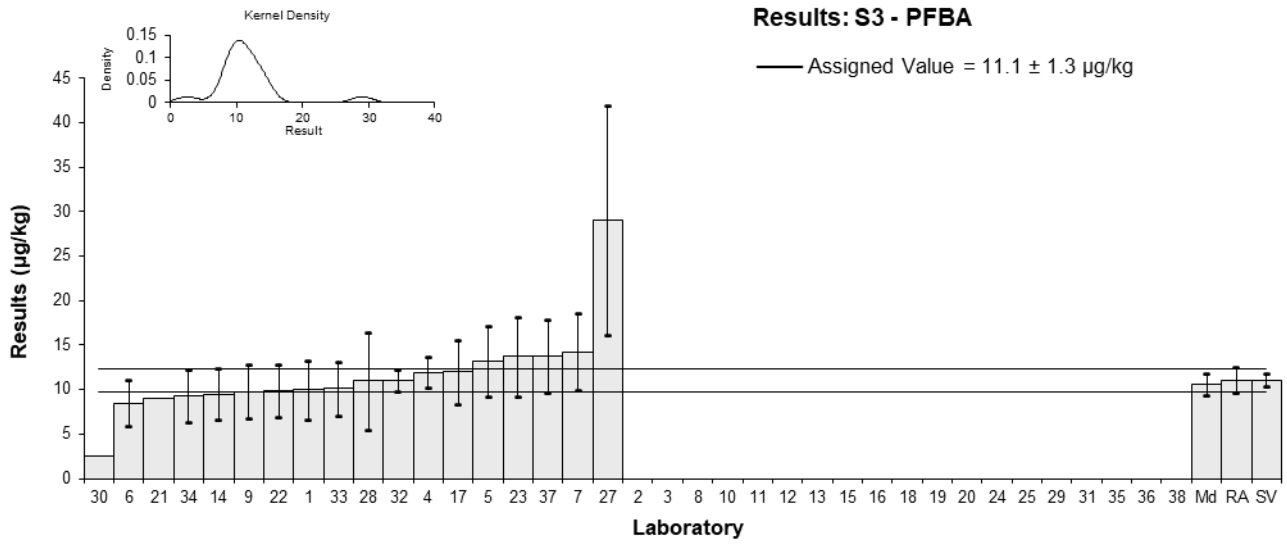
**Participant Results**

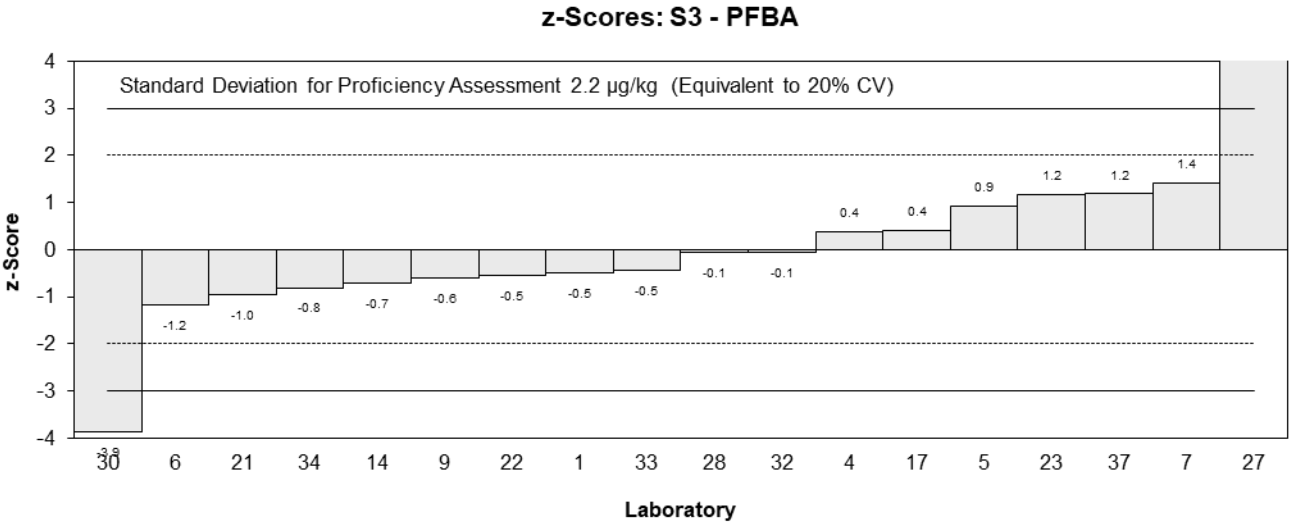
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 10 | 3.3 | 76 | -0.50 | -0.31 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 11.939 | 1.74 | 95 | 0.38 | 0.39 |
| **5** | 13.16708 | 3.950124 | 53 | 0.93 | 0.50 |
| **6** | 8.5 | 2.55 | 87 | -1.17 | -0.91 |
| **7** | 14.24 | 4.3 | NR | 1.41 | 0.70 |
| **8** | NS | NS | NS | | |
| **9** | 9.77 | 3.03 | 68 | -0.60 | -0.40 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | NR | NR | NR | | |
| **13** | <10 | NR | NR | | |
| **14** | 9.5 | 2.9 | 66 | -0.72 | -0.50 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 11.99567 | 3.598703 | 23 | 0.40 | 0.23 |
| **18** | NT | NT | NT | | |
| **19** | <0.1 | NR | 77 | | |
| **20** | <10 | NR | 84 | | |
| **21** | 9 | NR | 109 | -0.95 | -1.62 |
| **22** | 9.90 | 2.97 | 87 | -0.54 | -0.37 |
| **23** | 13.7 | 4.4 | 61 | 1.17 | 0.57 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 29 | 12.9 | NT | 8.06 | 1.38 |
| **28** | 11 | 5.5 | 56 | -0.05 | -0.02 |
| **29** | NS | NS | NS | | |
| **30*** | 2.5 | NR | NR | -3.87 | -6.62 |
| **31** | NS | NS | NS | | |
| **32** | 11 | 1.2 | NR | -0.05 | -0.06 |
| **33** | 10.11 | 3.03 | 71 | -0.45 | -0.30 |
| **34** | 9.3 | 3 | 41 | -0.81 | -0.55 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 13.73 | 4.119 | 101 | 1.18 | 0.61 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 11.1 | 1.3 |
| **Spike Value** | 11.1 | 0.7 |
| **Robust Average** | 11.1 | 1.4 |
| **Median** | 10.6 | 1.2 |
| **Mean** | 11.6 | |
| **N** | 18 | |
| **Max** | 29 | |
| **Min** | 2.5 | |
| **Robust SD** | 2.4 | |
| **Robust CV** | 22% | |


Kernel Density
Density
Result
Results: S3 - PFBA
Assigned Value = 11.1 ± 1.3 µg/kg
Results (µg/kg)
Laboratory
30 6 21 34 14 9 22 1 33 28 32 4 17 5 23 37 7 27 2 3 8 10 11 12 13 15 16 18 19 20 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - PFBA
Standard Deviation for Proficiency Assessment 2.2 µg/kg (Equivalent to 20% CV)
z-Score
-3.9 -1.2 -1.0 -0.8 -0.7 -0.6 -0.5 -0.5 -0.5 -0.1 -0.1 0.4 0.4 0.9 1.2 1.2 1.4
Laboratory
30 6 21 34 14 9 22 1 33 28 32 4 17 5 23 37 7 27

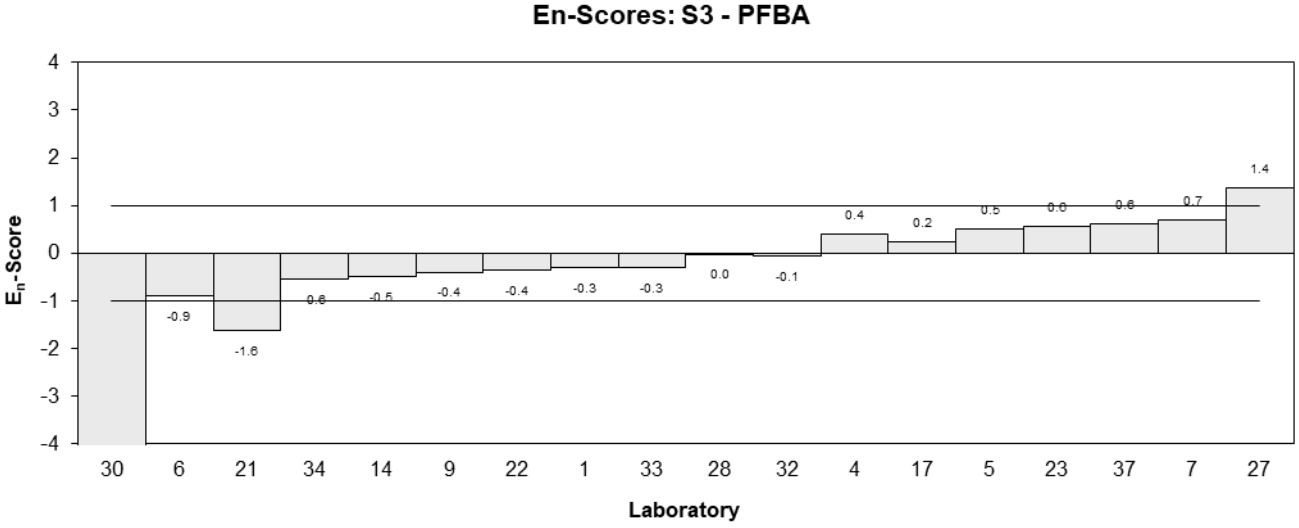

En-Scores: S3 - PFBA
En-Score
-0.9 -1.6 -0.6 -0.5 -0.4 -0.4 -0.3 -0.3 0.0 -0.1 0.4 0.2 0.5 0.6 0.6 0.7 1.4
Laboratory
30 6 21 34 14 9 22 1 33 28 32 4 17 5 23 37 7 27

Figure 52

Table 56

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFPeA |
| **Unit** | µg/kg |

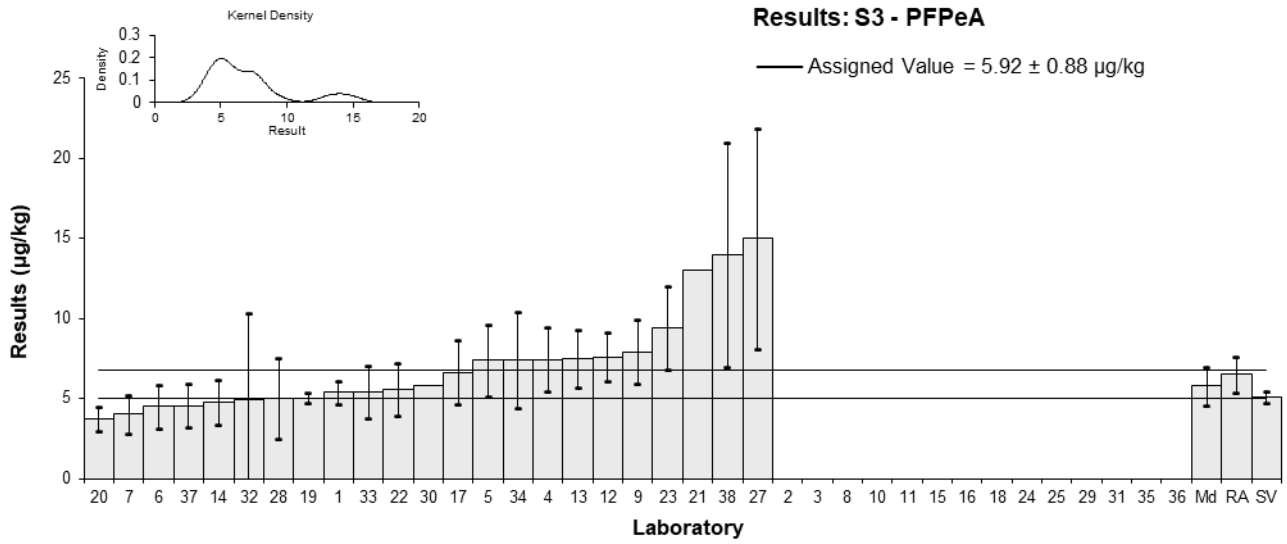
**Participant Results**

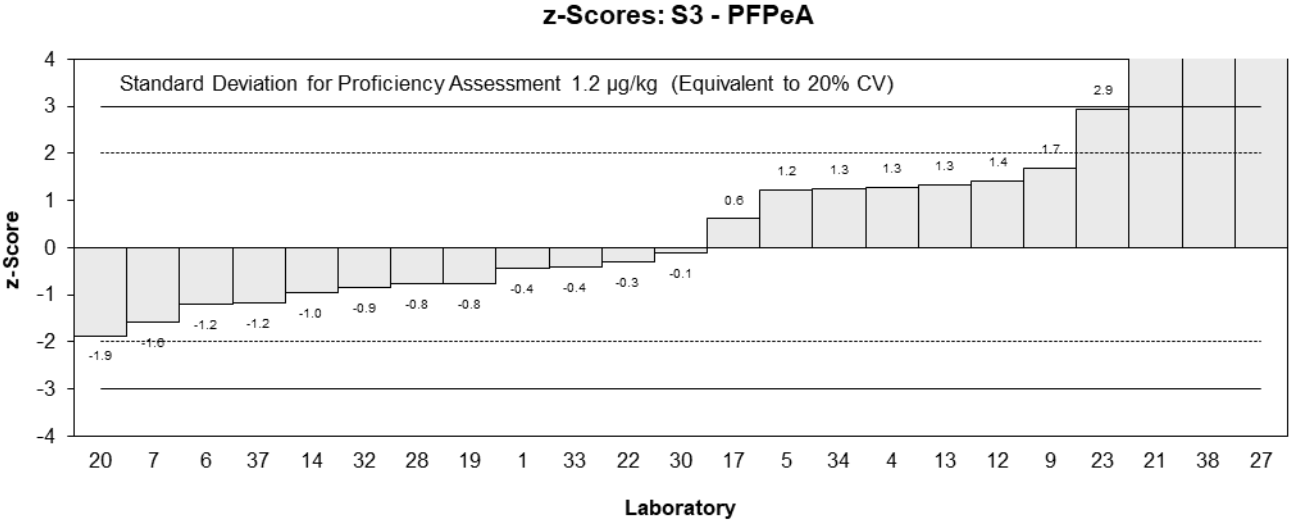
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 5.4 | 0.72 | 81 | -0.44 | -0.46 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 7.435 | 1.98 | 93 | 1.28 | 0.70 |
| **5** | 7.37518 | 2.212554 | 48 | 1.23 | 0.61 |
| **6** | 4.5 | 1.35 | 99 | -1.20 | -0.88 |
| **7** | 4.04 | 1.2 | NR | -1.59 | -1.26 |
| **8** | NS | NS | NS | | |
| **9** | 7.92 | 1.98 | 70 | 1.69 | 0.92 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 7.6 | 1.5 | 153 | 1.42 | 0.97 |
| **13** | 7.49 | 1.8 | 87 | 1.33 | 0.78 |
| **14** | 4.8 | 1.4 | 52 | -0.95 | -0.68 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 6.636640 | 1.990992 | 35 | 0.61 | 0.33 |
| **18** | NT | NT | NT | | |
| **19** | 5.02 | 0.316 | 75 | -0.76 | -0.96 |
| **20** | 3.7 | 0.77 | 109 | -1.87 | -1.90 |
| **21*** | 13 | NR | 100 | 5.98 | 8.05 |
| **22** | 5.56 | 1.67 | 99 | -0.30 | -0.19 |
| **23** | 9.4 | 2.6 | 78 | 2.94 | 1.27 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 15 | 6.9 | NT | 7.67 | 1.31 |
| **28** | 5 | 2.5 | 94 | -0.78 | -0.35 |
| **29** | NS | NS | NS | | |
| **30** | 5.78 | NR | NR | -0.12 | -0.16 |
| **31** | NS | NS | NS | | |
| **32** | 4.9 | 5.4 | NR | -0.86 | -0.19 |
| **33** | 5.42 | 1.63 | 75 | -0.42 | -0.27 |
| **34** | 7.4 | 3 | 67 | 1.25 | 0.47 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 4.53 | 1.359 | 115 | -1.17 | -0.86 |
| **38*** | 14 | 7 | NR | 6.82 | 1.15 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 5.92 | 0.88 |
| **Spike Value** | 5.11 | 0.36 |
| **Robust Average** | 6.5 | 1.1 |
| **Median** | 5.8 | 1.2 |
| **Mean** | 7.0 | |
| **N** | 23 | |
| **Max** | 15 | |
| **Min** | 3.7 | |
| **Robust SD** | 2.2 | |
| **Robust CV** | 34% | |


Kernel Density
Density
Result
Results: S3 - PFPeA
Assigned Value = 5.92 ± 0.88 µg/kg
Results (µg/kg)
Laboratory
20 7 6 37 14 32 28 19 1 33 22 30 17 5 34 4 13 12 9 23 21 38 27 2 3 8 10 11 15 16 18 24 25 29 31 35 36 Md RA SV


z-Scores: S3 - PFPeA
Standard Deviation for Proficiency Assessment 1.2 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
20 7 6 37 14 32 28 19 1 33 22 30 17 5 34 4 13 12 9 23 21 38 27

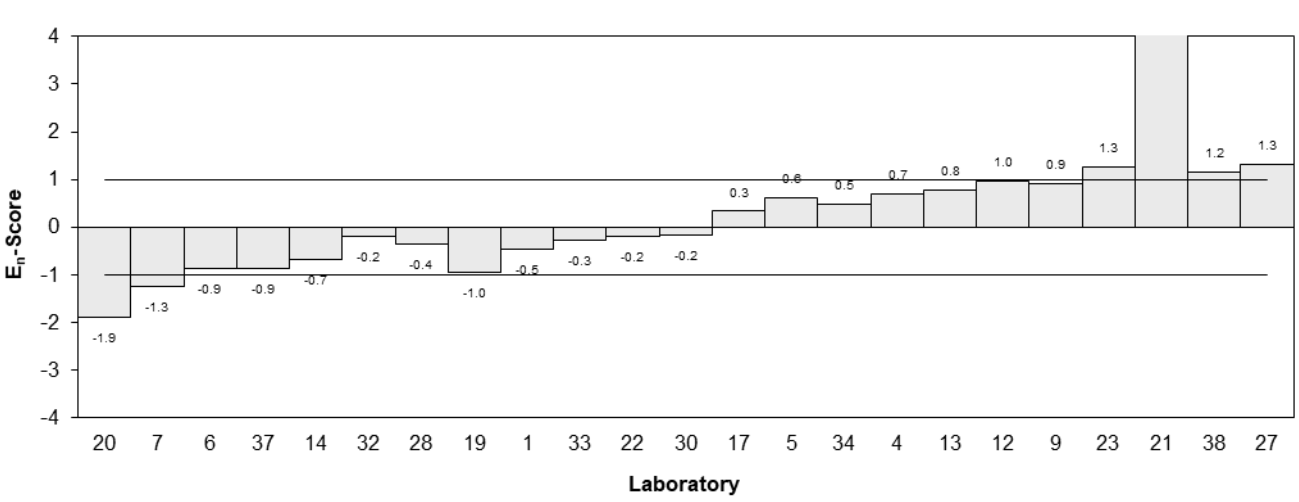

En-Scores: S3 - PFPeA
En-Score
Laboratory
20 7 6 37 14 32 28 19 1 33 22 30 17 5 34 4 13 12 9 23 21 38 27

Figure 53

Table 57

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFHxA |
| **Unit** | µg/kg |

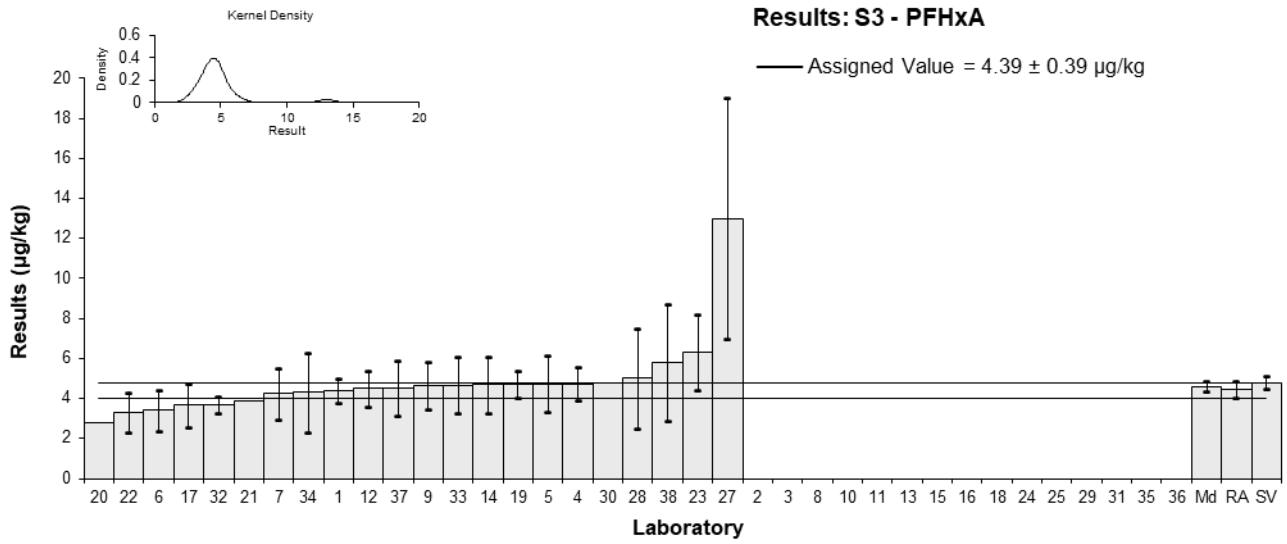
**Participant Results**

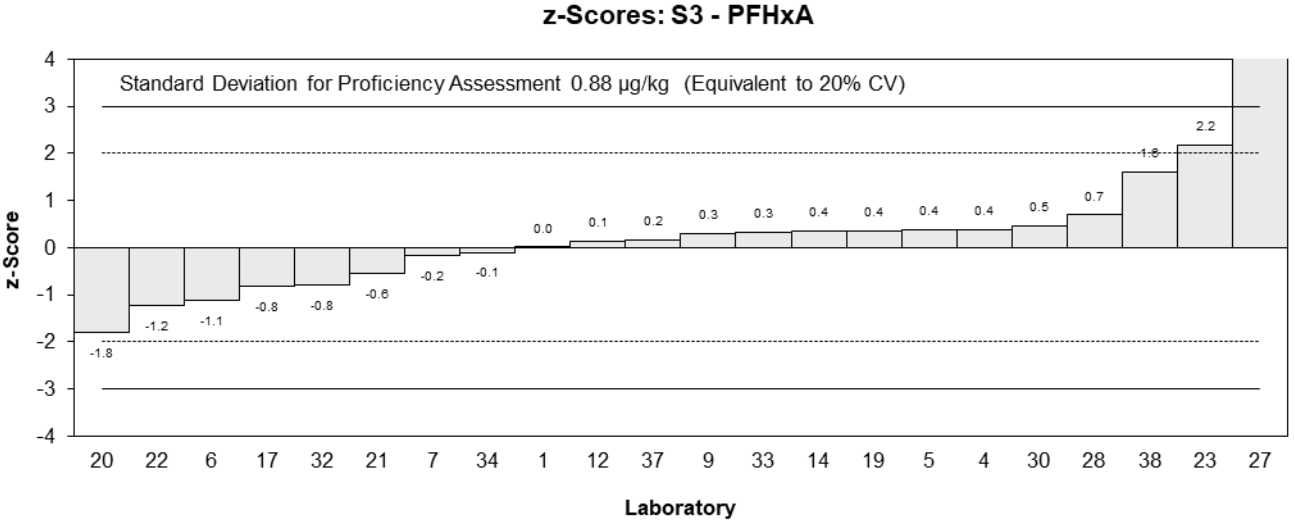
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 4.4 | 0.62 | 84 | 0.01 | 0.01 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 4.724 | 0.84 | 94 | 0.38 | 0.36 |
| **5** | 4.71813 | 1.415439 | 61 | 0.37 | 0.22 |
| **6** | 3.4 | 1.02 | 118 | -1.13 | -0.91 |
| **7** | 4.24 | 1.3 | NR | -0.17 | -0.11 |
| **8** | NS | NS | NS | | |
| **9** | 4.65 | 1.16 | 96 | 0.30 | 0.21 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 4.5 | 0.90 | 57 | 0.13 | 0.11 |
| **13** | <5 | NR | NR | | |
| **14** | 4.7 | 1.4 | 62 | 0.35 | 0.21 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 3.671104 | 1.101331 | 40 | -0.82 | -0.62 |
| **18** | NT | NT | NT | | |
| **19** | 4.71 | 0.682 | 124 | 0.36 | 0.41 |
| **20** | 2.8 | NR | 111 | -1.81 | -4.08 |
| **21** | 3.9 | NR | 83 | -0.56 | -1.26 |
| **22** | 3.32 | 0.99 | 118 | -1.22 | -1.01 |
| **23** | 6.3 | 1.9 | 101 | 2.18 | 0.98 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 13 | 6.0 | NT | 9.81 | 1.43 |
| **28** | 5 | 2.5 | 86 | 0.69 | 0.24 |
| **29** | NS | NS | NS | | |
| **30** | 4.8 | NR | NR | 0.47 | 1.05 |
| **31** | NS | NS | NS | | |
| **32** | 3.7 | 0.41 | NR | -0.79 | -1.22 |
| **33** | 4.67 | 1.40 | 89 | 0.32 | 0.19 |
| **34** | 4.3 | 2 | 98 | -0.10 | -0.04 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 4.52 | 1.356 | 113 | 0.15 | 0.09 |
| **38** | 5.8 | 2.9 | NR | 1.61 | 0.48 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 4.39 | 0.39 |
| **Spike Value** | 4.78 | 0.32 |
| **Robust Average** | 4.46 | 0.43 |
| **Median** | 4.59 | 0.25 |
| **Mean** | 4.81 | |
| **N** | 22 | |
| **Max** | 13 | |
| **Min** | 2.8 | |
| **Robust SD** | 0.81 | |
| **Robust CV** | 18% | |


Kernel Density
Density
Result
Results: S3 - PFHxA
Assigned Value = 4.39 ± 0.39 µg/kg
Results (µg/kg)
Laboratory
20 22 6 17 32 21 7 34 1 12 37 9 33 14 19 5 4 30 28 38 23 27 2 3 8 10 11 13 15 16 18 24 25 29 31 35 36 Md RA SV


z-Scores: S3 - PFHxA
Standard Deviation for Proficiency Assessment 0.88 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
20 22 6 17 32 21 7 34 1 12 37 9 33 14 19 5 4 30 28 38 23 27
-1.8 -1.2 -1.1 -0.8 -0.8 -0.6 -0.2 -0.1 0.0 0.1 0.2 0.3 0.3 0.4 0.4 0.4 0.4 0.5 0.7 1.6 2.2

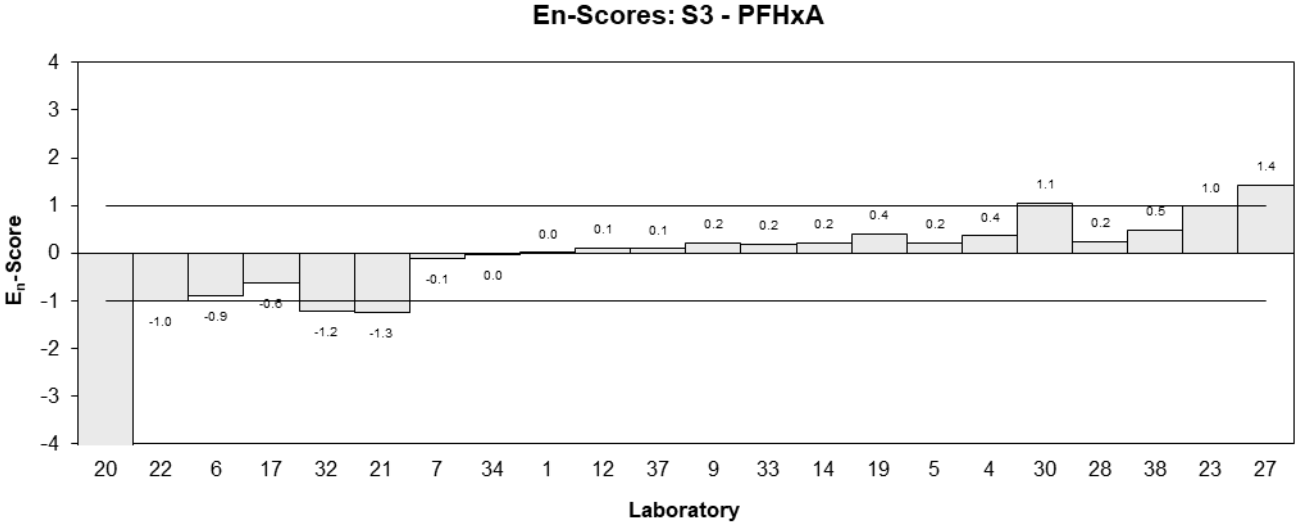

En-Scores: S3 - PFHxA
En-Score
Laboratory
20 22 6 17 32 21 7 34 1 12 37 9 33 14 19 5 4 30 28 38 23 27
-1.0 -0.9 -0.6 -1.2 -1.3 -0.1 0.0 0.0 0.1 0.1 0.2 0.2 0.2 0.4 0.2 0.4 1.1 0.2 0.5 1.0 1.4

Figure 54

Table 58

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFHpA |
| **Unit** | µg/kg |

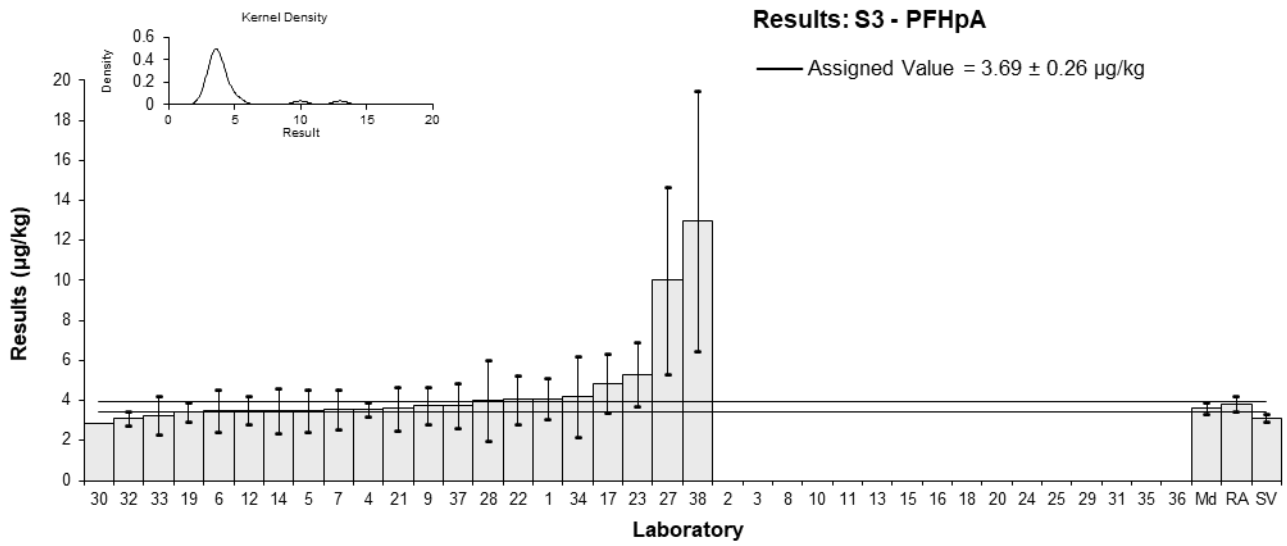
**Participant Results**

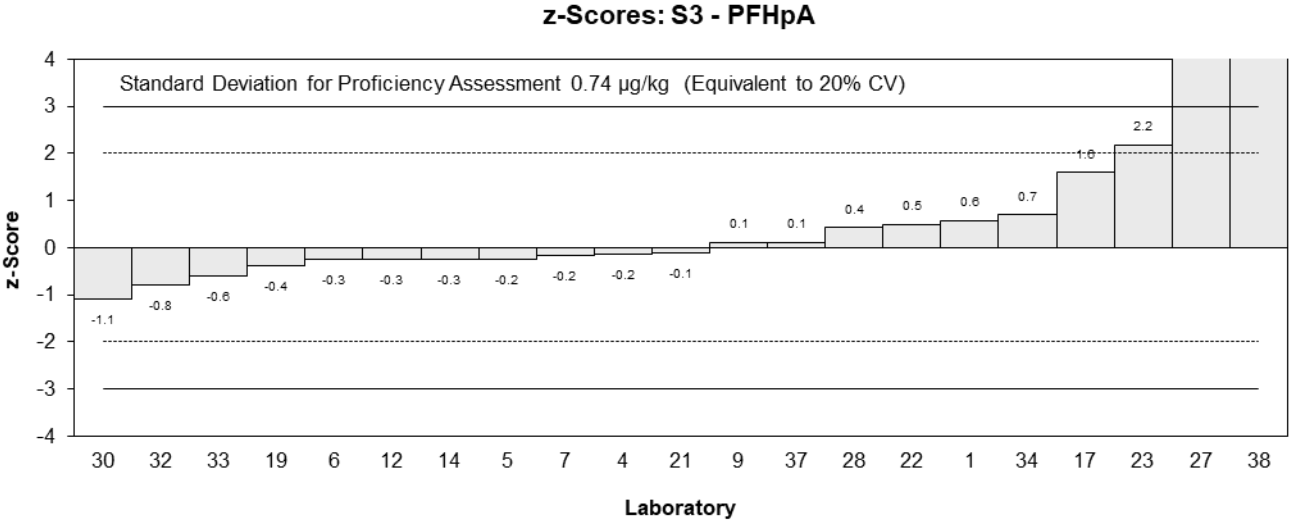
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 4.1 | 1.0 | 91 | 0.56 | 0.40 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 3.577 | 0.34 | 97 | -0.15 | -0.26 |
| **5** | 3.51206 | 1.053618 | 71 | -0.24 | -0.16 |
| **6** | 3.5 | 1.05 | 99 | -0.26 | -0.18 |
| **7** | 3.57 | 1 | NR | -0.16 | -0.12 |
| **8** | NS | NS | NS | | |
| **9** | 3.77 | 0.94 | 98 | 0.11 | 0.08 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 3.5 | 0.70 | 81 | -0.26 | -0.25 |
| **13** | <5 | NR | NR | | |
| **14** | 3.5 | 1.1 | 83 | -0.26 | -0.17 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 4.864584 | 1.459375 | 30 | 1.59 | 0.79 |
| **18** | NT | NT | NT | | |
| **19** | 3.41 | 0.476 | 49 | -0.38 | -0.52 |
| **20** | <2.5 | NR | 87 | | |
| **21** | 3.6 | 1.1 | 92 | -0.12 | -0.08 |
| **22** | 4.05 | 1.21 | 99 | 0.49 | 0.29 |
| **23** | 5.3 | 1.6 | 107 | 2.18 | 0.99 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 10 | 4.7 | NT | 8.55 | 1.34 |
| **28** | 4 | 2 | 101 | 0.42 | 0.15 |
| **29** | NS | NS | NS | | |
| **30** | 2.88 | NR | NR | -1.10 | -3.12 |
| **31** | NS | NS | NS | | |
| **32** | 3.1 | 0.34 | NR | -0.80 | -1.38 |
| **33** | 3.25 | 0.97 | 104 | -0.60 | -0.44 |
| **34** | 4.2 | 2 | 89 | 0.69 | 0.25 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 3.77 | 1.131 | 104 | 0.11 | 0.07 |
| **38*** | 13 | 6.5 | NR | 12.62 | 1.43 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 3.69 | 0.26 |
| **Spike Value** | 3.14 | 0.22 |
| **Robust Average** | 3.84 | 0.37 |
| **Median** | 3.60 | 0.28 |
| **Mean** | 4.5 | |
| **N** | 21 | |
| **Max** | 13 | |
| **Min** | 2.88 | |
| **Robust SD** | 0.67 | |
| **Robust CV** | 17% | |


Results: S3 - PFHpA
Assigned Value = 3.69 ± 0.26 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
30 32 33 19 6 12 14 5 7 4 21 9 37 28 22 1 34 17 23 27 38 2 3 8 10 11 13 15 16 18 20 24 25 29 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFHpA
Standard Deviation for Proficiency Assessment 0.74 µg/kg (Equivalent to 20% CV)
z-Score
-1.1 -0.8 -0.6 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.1 0.1 0.1 0.4 0.5 0.6 0.7 1.6 2.2
30 32 33 19 6 12 14 5 7 4 21 9 37 28 22 1 34 17 23 27 38
Laboratory

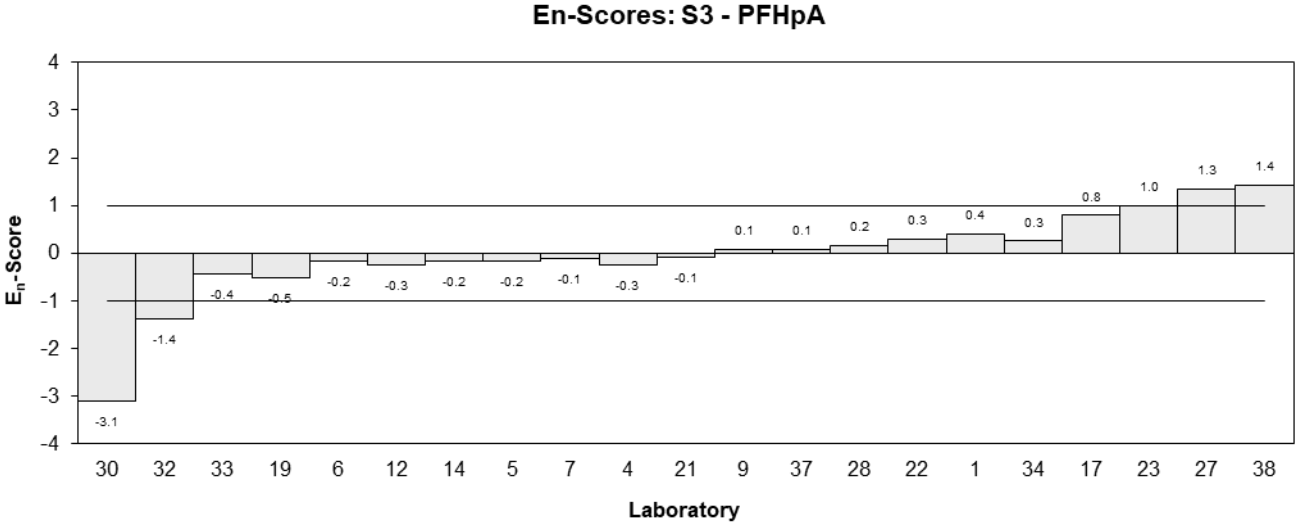

En-Scores: S3 - PFHpA
En-Score
-3.1 -1.4 -0.4 -0.5 -0.2 -0.3 -0.2 -0.2 -0.1 -0.3 -0.1 0.1 0.1 0.2 0.3 0.4 0.3 0.8 1.0 1.3 1.4
30 32 33 19 6 12 14 5 7 4 21 9 37 28 22 1 34 17 23 27 38
Laboratory

Figure 55

Table 59

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFOA |
| **Unit** | µg/kg |

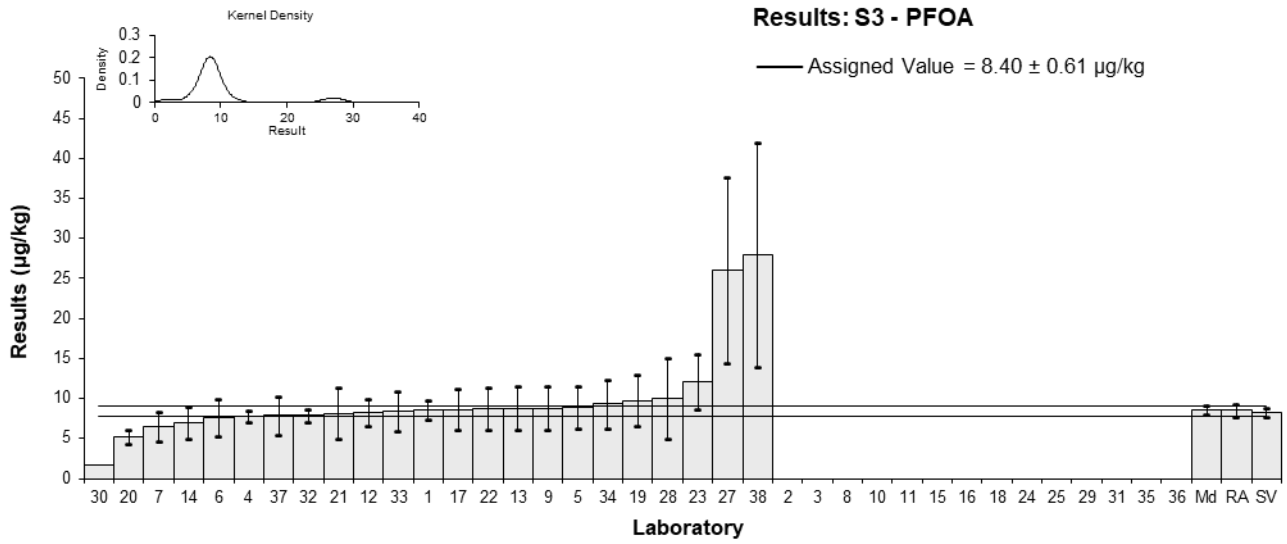
**Participant Results**

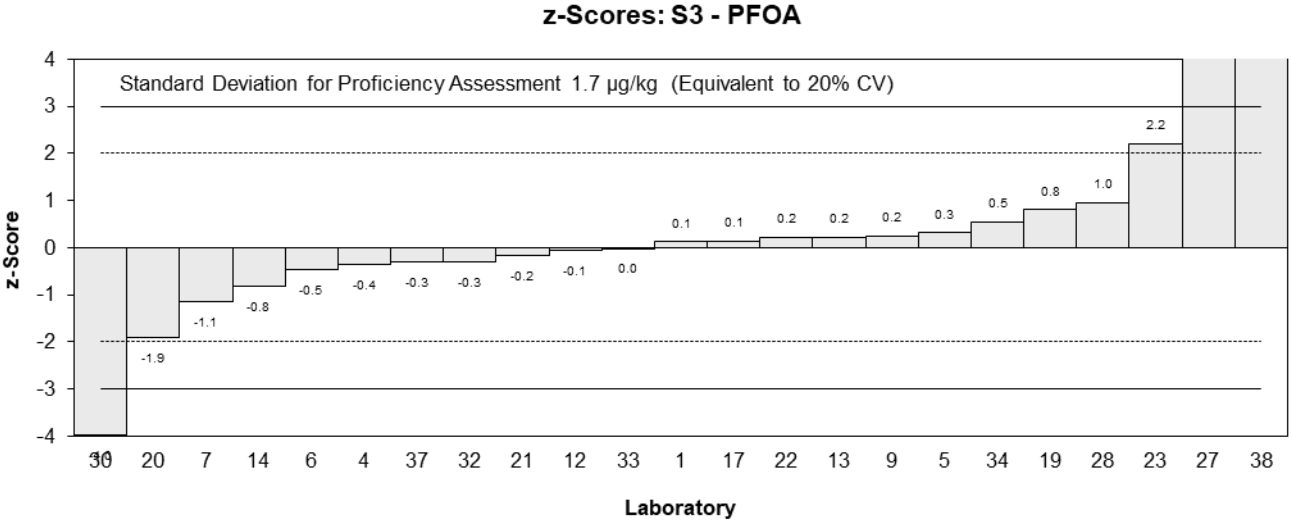
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 8.6 | 1.2 | 102 | 0.12 | 0.15 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 7.78 | 0.77 | 100 | -0.37 | -0.63 |
| **5** | 8.91486 | 2.674458 | 96 | 0.31 | 0.19 |
| **6** | 7.6 | 2.28 | 101 | -0.48 | -0.34 |
| **7** | 6.48 | 1.9 | NR | -1.14 | -0.96 |
| **8** | NS | NS | NS | | |
| **9** | 8.81 | 2.73 | 104 | 0.24 | 0.15 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 8.3 | 1.7 | 108 | -0.06 | -0.06 |
| **13** | 8.76 | 2.72 | 63 | 0.21 | 0.13 |
| **14** | 7 | 2 | 79 | -0.83 | -0.67 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 8.617869 | 2.585360 | 60 | 0.13 | 0.08 |
| **18** | NT | NT | NT | | |
| **19** | 9.74 | 3.19 | 60 | 0.80 | 0.41 |
| **20** | 5.19 | 0.9 | 81 | -1.91 | -2.95 |
| **21** | 8.1 | 3.2 | 106 | -0.18 | -0.09 |
| **22** | 8.75 | 2.63 | 101 | 0.21 | 0.13 |
| **23** | 12.1 | 3.5 | 107 | 2.20 | 1.04 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 26 | 11.6 | NT | 10.48 | 1.52 |
| **28** | 10 | 5 | 117 | 0.95 | 0.32 |
| **29** | NS | NS | NS | | |
| **30*** | 1.7 | NR | NR | -3.99 | -10.98 |
| **31** | NS | NS | NS | | |
| **32** | 7.9 | 0.83 | NR | -0.30 | -0.49 |
| **33** | 8.37 | 2.51 | 103 | -0.02 | -0.01 |
| **34** | 9.3 | 3 | 93 | 0.54 | 0.29 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 7.88 | 2.364 | 112 | -0.31 | -0.21 |
| **38*** | 28 | 14 | NR | 11.67 | 1.40 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 8.40 | 0.61 |
| **Spike Value** | 8.29 | 0.58 |
| **Robust Average** | 8.51 | 0.79 |
| **Median** | 8.60 | 0.56 |
| **Mean** | 9.7 | |
| **N** | 23 | |
| **Max** | 28 | |
| **Min** | 1.7 | |
| **Robust SD** | 1.5 | |
| **Robust CV** | 18% | |


Kernel Density
Density
Result
Results: S3 - PFOA
Assigned Value = 8.40 ± 0.61 µg/kg
Results (µg/kg)
30 20 7 14 6 4 37 32 21 12 33 1 17 22 13 9 5 34 19 28 23 27 38 2 3 8 10 11 15 16 18 24 25 29 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFOA
Standard Deviation for Proficiency Assessment 1.7 µg/kg (Equivalent to 20% CV)
z-Score
30 20 7 14 6 4 37 32 21 12 33 1 17 22 13 9 5 34 19 28 23 27 38
Laboratory

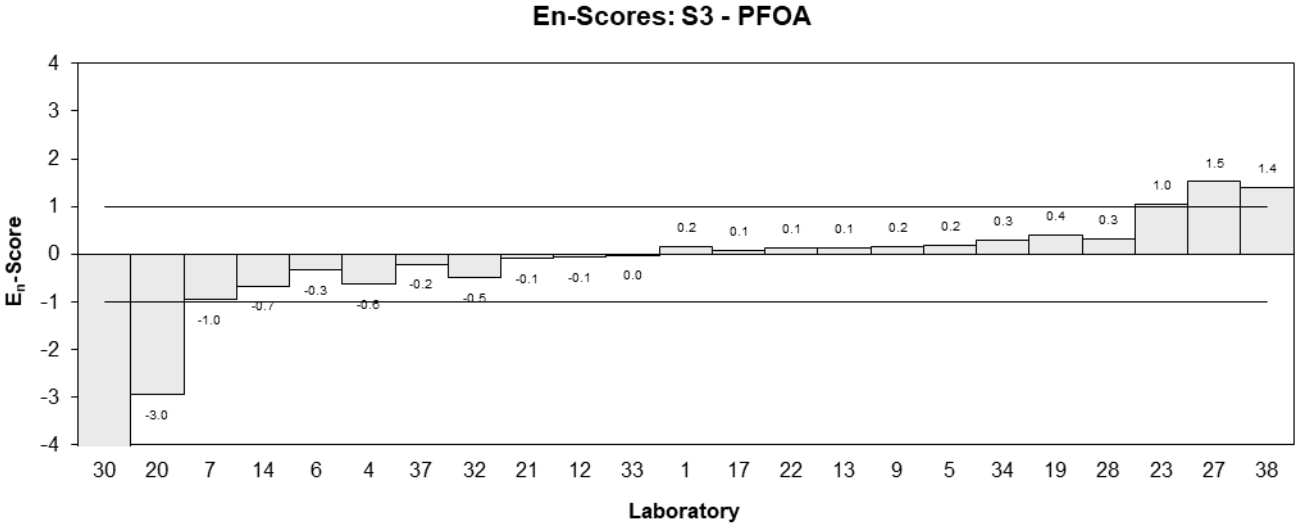

En-Scores: S3 - PFOA
En-Score
30 20 7 14 6 4 37 32 21 12 33 1 17 22 13 9 5 34 19 28 23 27 38
Laboratory

Figure 56

Table 60

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFNA |
| **Unit** | µg/kg |

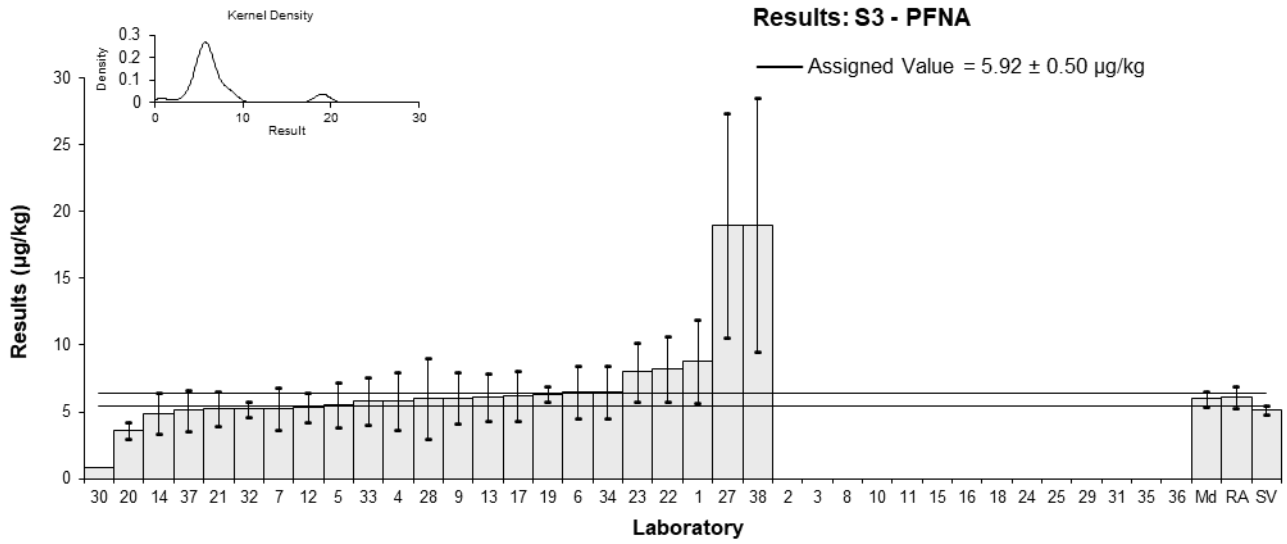
**Participant Results**

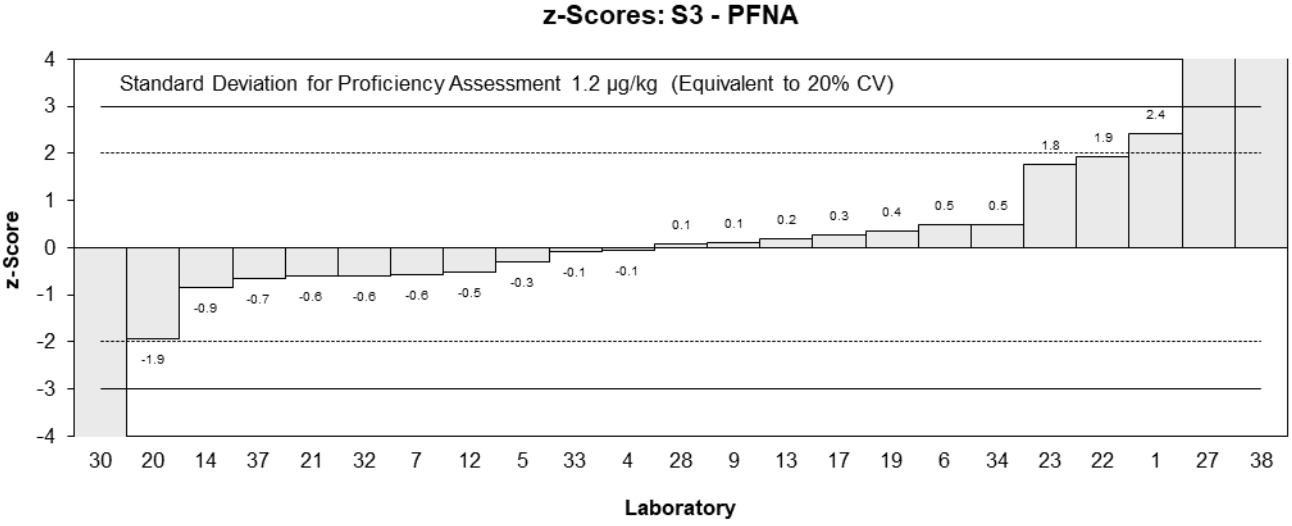
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 8.8 | 3.1 | 102 | 2.43 | 0.92 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 5.834 | 2.19 | 102 | -0.07 | -0.04 |
| **5** | 5.55499 | 1.666497 | 101 | -0.31 | -0.21 |
| **6** | 6.5 | 1.95 | 118 | 0.49 | 0.29 |
| **7** | 5.25 | 1.6 | NR | -0.57 | -0.40 |
| **8** | NS | NS | NS | | |
| **9** | 6.05 | 1.94 | 91 | 0.11 | 0.06 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 5.3 | 1.1 | 107 | -0.52 | -0.51 |
| **13** | 6.14 | 1.78 | 75 | 0.19 | 0.12 |
| **14** | 4.9 | 1.5 | 69 | -0.86 | -0.65 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 6.243426 | 1.873027 | 75 | 0.27 | 0.17 |
| **18** | NT | NT | NT | | |
| **19** | 6.33 | 0.545 | 59 | 0.35 | 0.55 |
| **20** | 3.64 | 0.63 | 121 | -1.93 | -2.83 |
| **21** | 5.2 | 1.3 | 100 | -0.61 | -0.52 |
| **22** | 8.20 | 2.46 | 118 | 1.93 | 0.91 |
| **23** | 8 | 2.2 | 113 | 1.76 | 0.92 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 19 | 8.4 | NT | 11.05 | 1.55 |
| **28** | 6 | 3 | 139 | 0.07 | 0.03 |
| **29** | NS | NS | NS | | |
| **30*** | 0.8 | NR | NR | -4.32 | -10.24 |
| **31** | NS | NS | NS | | |
| **32** | 5.2 | 0.57 | NR | -0.61 | -0.95 |
| **33** | 5.82 | 1.75 | 98 | -0.08 | -0.05 |
| **34** | 6.5 | 2 | 105 | 0.49 | 0.28 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 5.14 | 1.542 | 115 | -0.66 | -0.48 |
| **38*** | 19 | 9.5 | NR | 11.05 | 1.37 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 5.92 | 0.50 |
| **Spike Value** | 5.15 | 0.36 |
| **Robust Average** | 6.14 | 0.81 |
| **Median** | 6.00 | 0.58 |
| **Mean** | 6.9 | |
| **N** | 23 | |
| **Max** | 19 | |
| **Min** | 0.8 | |
| **Robust SD** | 1.6 | |
| **Robust CV** | 25% | |


Results: S3 - PFNA
Kernel Density
Density
Result
Assigned Value = 5.92 ± 0.50 µg/kg
Results (µg/kg)
30 20 14 37 21 32 7 12 5 33 4 28 9 13 17 19 6 34 23 22 1 27 38 2 3 8 10 11 15 16 18 24 25 29 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFNA
Standard Deviation for Proficiency Assessment 1.2 µg/kg (Equivalent to 20% CV)
z-Score
30 20 14 37 21 32 7 12 5 33 4 28 9 13 17 19 6 34 23 22 1 27 38
Laboratory

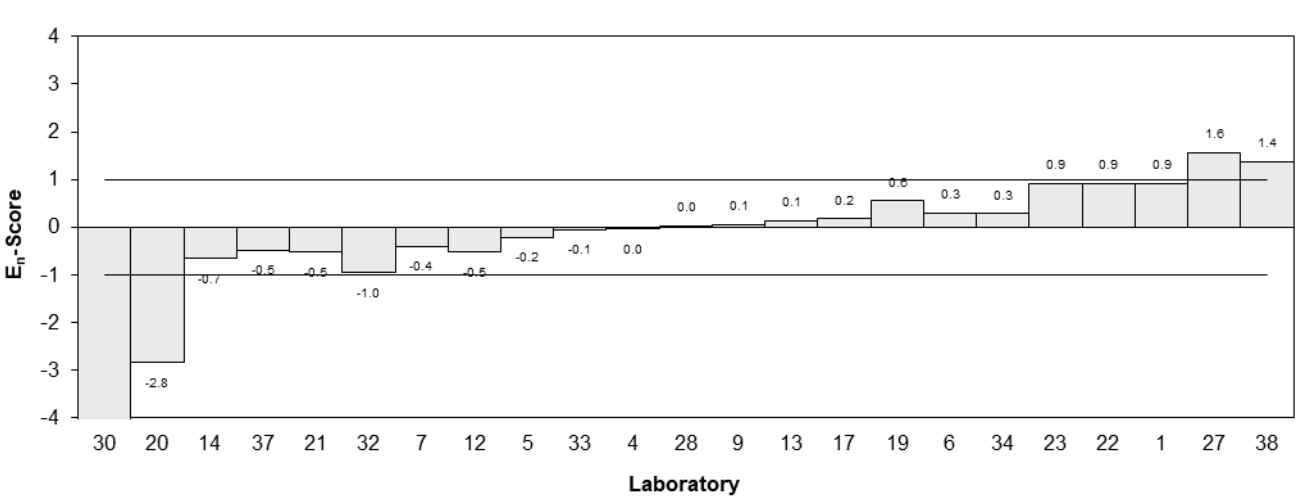

En-Scores: S3 - PFNA
En-Score
30 20 14 37 21 32 7 12 5 33 4 28 9 13 17 19 6 34 23 22 1 27 38
Laboratory

Figure 57

Table 61

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFDA |
| **Unit** | µg/kg |

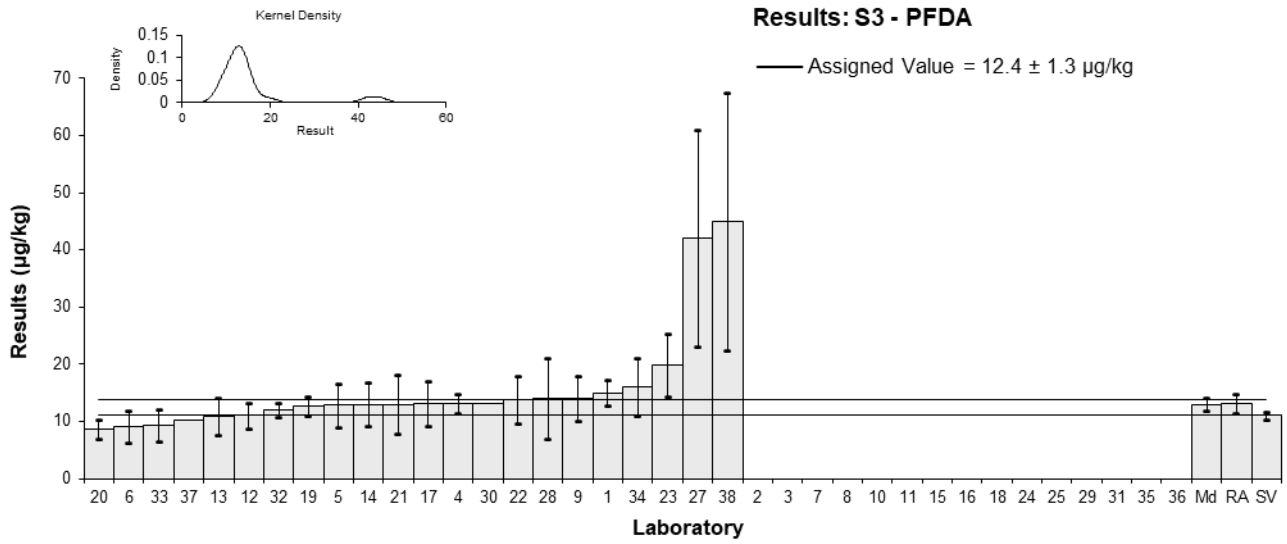
**Participant Results**

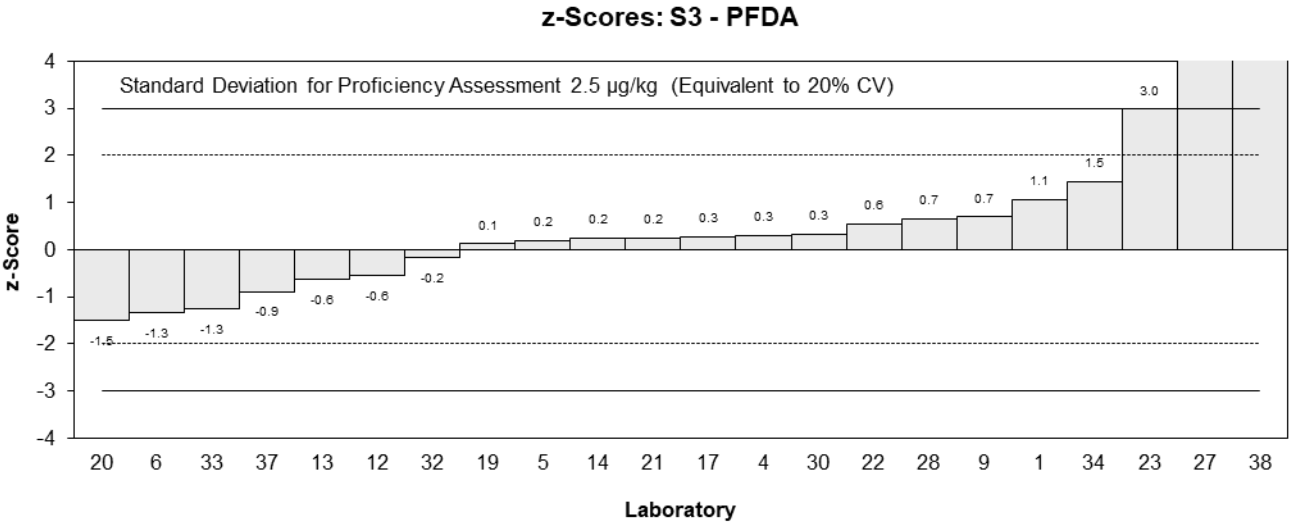
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 15 | 2.3 | 102 | 1.05 | 0.98 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 13.13 | 1.67 | 105 | 0.29 | 0.34 |
| **5** | 12.85349 | 3.856047 | 97 | 0.18 | 0.11 |
| **6** | 9.1 | 2.73 | 86 | -1.33 | -1.09 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | 14.1 | 3.9 | 89 | 0.69 | 0.41 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 11 | 2.2 | 132 | -0.56 | -0.55 |
| **13** | 10.81 | 3.24 | 83 | -0.64 | -0.46 |
| **14** | 13 | 3.9 | 53 | 0.24 | 0.15 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 13.06322 | 3.918967 | 78 | 0.27 | 0.16 |
| **18** | NT | NT | NT | | |
| **19** | 12.7 | 1.76 | 71 | 0.12 | 0.14 |
| **20** | 8.67 | 1.61 | 91 | -1.50 | -1.80 |
| **21** | 13 | 5.2 | 106 | 0.24 | 0.11 |
| **22** | 13.77 | 4.13 | 86 | 0.55 | 0.32 |
| **23*** | 19.8 | 5.5 | 117 | 2.98 | 1.31 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 42 | 19 | NT | 11.94 | 1.55 |
| **28** | 14 | 7 | 163 | 0.65 | 0.22 |
| **29** | NS | NS | NS | | |
| **30** | 13.2 | NR | NR | 0.32 | 0.62 |
| **31** | NS | NS | NS | | |
| **32** | 12 | 1.3 | NR | -0.16 | -0.22 |
| **33** | 9.31 | 2.79 | 71 | -1.25 | -1.00 |
| **34** | 16 | 5 | 106 | 1.45 | 0.70 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 10.2 | NR | 118 | -0.89 | -1.69 |
| **38*** | 45 | 22.5 | NR | 13.15 | 1.45 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 12.4 | 1.3 |
| **Spike Value** | 11.0 | 0.7 |
| **Robust Average** | 13.1 | 1.6 |
| **Median** | 13.0 | 1.2 |
| **Mean** | 15.5 | |
| **N** | 22 | |
| **Max** | 45 | |
| **Min** | 8.67 | |
| **Robust SD** | 2.9 | |
| **Robust CV** | 22% | |


Results: S3 - PFDA
Kernel Density
Density
Result
Assigned Value = 12.4 ± 1.3 µg/kg
Results (µg/kg)
Laboratory
20 6 33 37 13 12 32 19 5 14 21 17 4 30 22 28 9 1 34 23 27 38 2 3 7 8 10 11 15 16 18 24 25 29 31 35 36 Md RA SV


z-Scores: S3 - PFDA
Standard Deviation for Proficiency Assessment 2.5 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
20 6 33 37 13 12 32 19 5 14 21 17 4 30 22 28 9 1 34 23 27 38

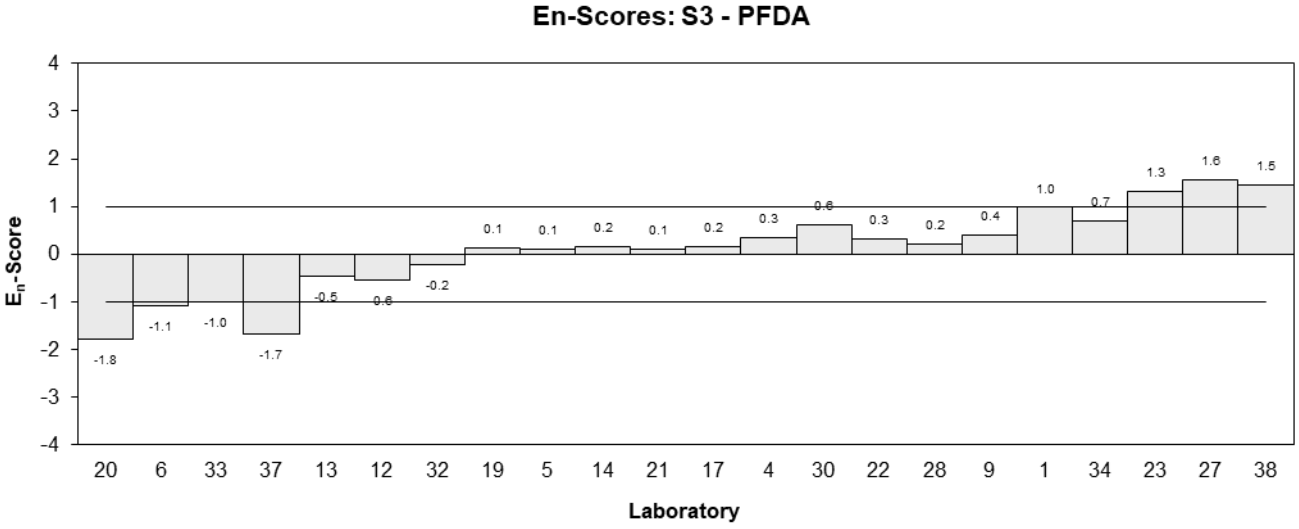

En-Scores: S3 - PFDA
En-Score
Laboratory
20 6 33 37 13 12 32 19 5 14 21 17 4 30 22 28 9 1 34 23 27 38

Figure 58

Table 62

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFDoA |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | <1.0 | NR | 112 |
| **2** | NS | NS | NS |
| **3** | NS | NS | NS |
| **4** | 1.18 | 0.23 | 102 |
| **5** | 0.80142 | 0.240426 | 48 |
| **6** | <0.001 | NR | NR |
| **7** | <0.1 | NR | NR |
| **8** | NS | NS | NS |
| **9** | <0.5 | NR | NR |
| **10** | NS | NS | NS |
| **11** | NS | NS | NS |
| **12** | NR | NR | NR |
| **13** | <5 | NR | NR |
| **14** | 0.35 | 0.11 | 58 |
| **15** | NS | NS | NS |
| **16** | NS | NS | NS |
| **17** | 0.878751 | 0.263625 | 74 |
| **18** | NT | NT | NT |
| **19** | 0.721 | 0.0908 | 23 |
| **20** | <2.5 | NR | 12 |
| **21** | 0.6 | 0.2 | 83 |
| **22** | <0.001 | NR | NR |
| **23** | <1 | NR | 122 |
| **24** | NT | NT | NT |
| **25** | <5 | NR | NR |
| **27** | 1.9 | 0.85 | NT |
| **28** | < 20 | 10 | 126 |
| **29** | NS | NS | NS |
| **30** | 0.57 | NR | NR |
| **31** | NS | NS | NS |
| **32** | <1 | NR | NR |
| **33** | < 0.5 | NR | 50 |
| **34** | 0.8 | 0.3 | 124 |
| **35** | NS | NS | NS |
| **36** | NS | NS | NS |
| **37** | <0.5 | NR | 117 |
| **38** | NT | NT | NT |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 0.80 | 0.28 |
| **Median** | 0.80 | 0.25 |
| **Mean** | 0.87 | |
| **N** | 9 | |
| **Max** | 1.9 | |
| **Min** | 0.35 | |
| **Robust SD** | 0.34 | |
| **Robust CV** | 42% | |

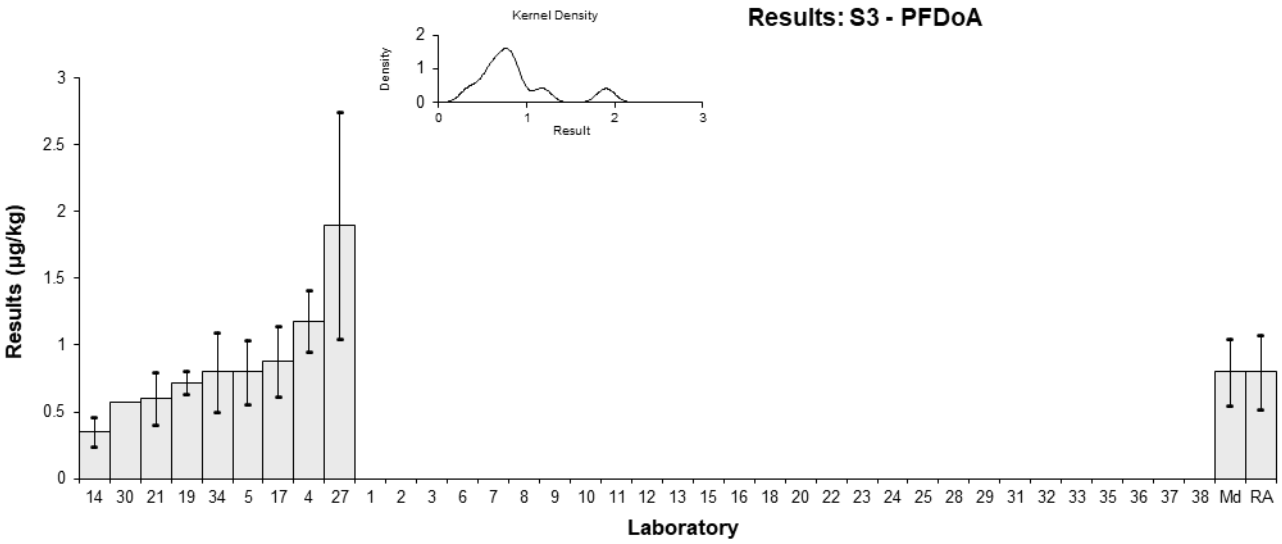

Results: S3 - PFDoA
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
14 30 21 19 34 5 17 4 27 1 2 3 6 7 8 9 10 11 12 13 15 16 18 20 22 23 24 25 28 29 31 32 33 35 36 37 38 Md RA

Figure 59

Table 63

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFTrDA |
| **Unit** | µg/kg |

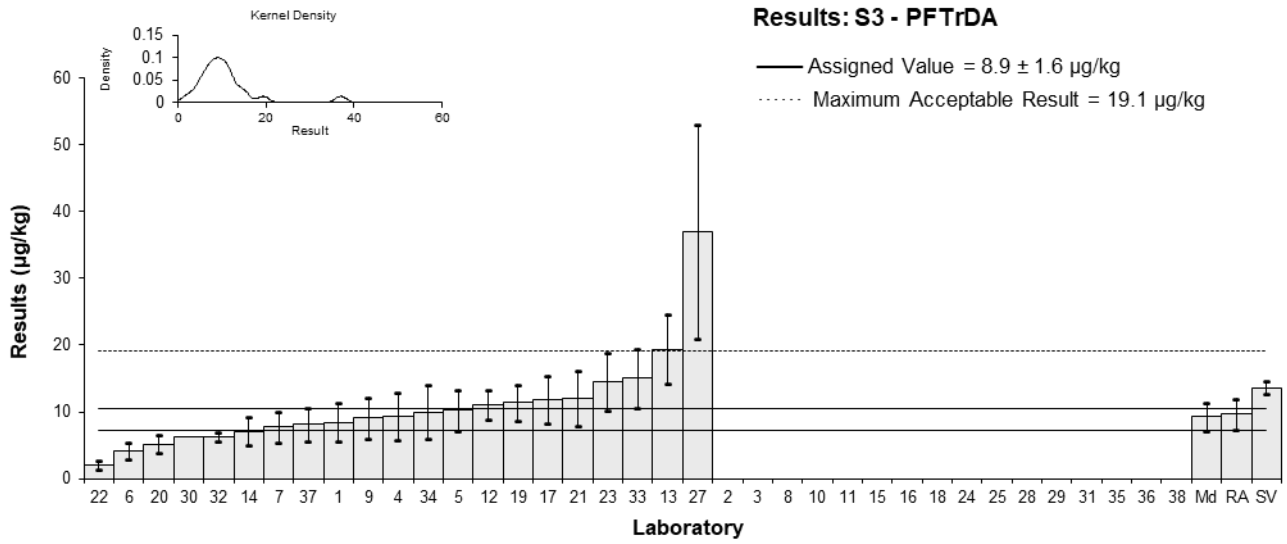
**Participant Results**

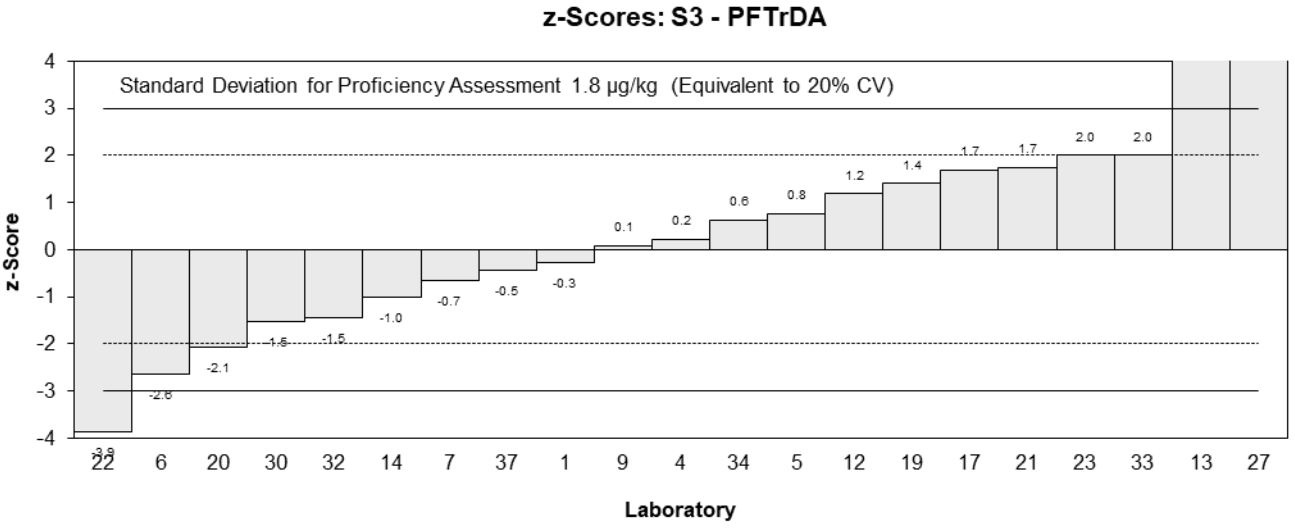
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 8.4 | 2.9 | 112 | -0.28 | -0.15 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 9.267 | 3.59 | NR | 0.21 | 0.09 |
| **5** | 10.22704 | 3.068112 | 48 | 0.75 | 0.38 |
| **6*** | 4.2 | 1.26 | 153 | -2.64 | -2.31 |
| **7** | 7.74 | 2.3 | NR | -0.65 | -0.41 |
| **8** | NS | NS | NS | | |
| **9** | 9.05 | 3.08 | 91 | 0.08 | 0.04 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 11 | 2.2 | NR | 1.18 | 0.77 |
| **13*** | 19.4 | 5.24 | NR | 5.90 | 1.92 |
| **14** | 7.1 | 2.1 | 86 | -1.01 | -0.68 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 11.90100 | 3.570301 | 74 | 1.69 | 0.77 |
| **18** | NT | NT | NT | | |
| **19** | 11.4 | 2.7 | 16 | 1.40 | 0.80 |
| **20** | 5.19 | 1.38 | 87 | -2.08 | -1.76 |
| **21** | 12 | 4.2 | NR | 1.74 | 0.69 |
| **22*** | 2.01 | 0.60 | 153 | -3.87 | -4.03 |
| **23*** | 14.5 | 4.4 | NR | 2.00▼ | |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 37 | 16 | NT | 15.79 | 1.75 |
| **28** | < 70 | 35 | NR | | |
| **29** | NS | NS | NS | | |
| **30** | 6.16 | NR | NR | -1.54 | -1.71 |
| **31** | NS | NS | NS | | |
| **32** | 6.3 | 0.69 | NR | -1.46 | -1.49 |
| **33*** | 15.00 | 4.50 | NR | 2.00▼ | |
| **34** | 10 | 4 | 166 | 0.62 | 0.26 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 8.1 | 2.43 | 108 | -0.45 | -0.27 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2; ▼ Adjusted Score, see Section 6.3

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 8.9 | 1.6 |
| **Spike Value** | 13.6 | 1.0 |
| **Robust Average** | 9.7 | 2.3 |
| **Max Acceptable Result** | 19.1 | |
| **Median** | 9.3 | 2.1 |
| **Mean** | 10.8 | |
| **N** | 21 | |
| **Max** | 37 | |
| **Min** | 2.01 | |
| **Robust SD** | 4.2 | |
| **Robust CV** | 44% | |


Kernel Density
Density
Result
Results: S3 - PFTrDA
Assigned Value = 8.9 ± 1.6 µg/kg
Maximum Acceptable Result = 19.1 µg/kg
Results (µg/kg)
Laboratory
22 6 20 30 32 14 7 37 1 9 4 34 5 12 19 17 21 23 33 13 27 2 3 8 10 11 15 16 18 24 25 28 29 31 35 36 38 Md RA SV


z-Scores: S3 - PFTrDA
Standard Deviation for Proficiency Assessment 1.8 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
22 6 20 30 32 14 7 37 1 9 4 34 5 12 19 17 21 23 33 13 27

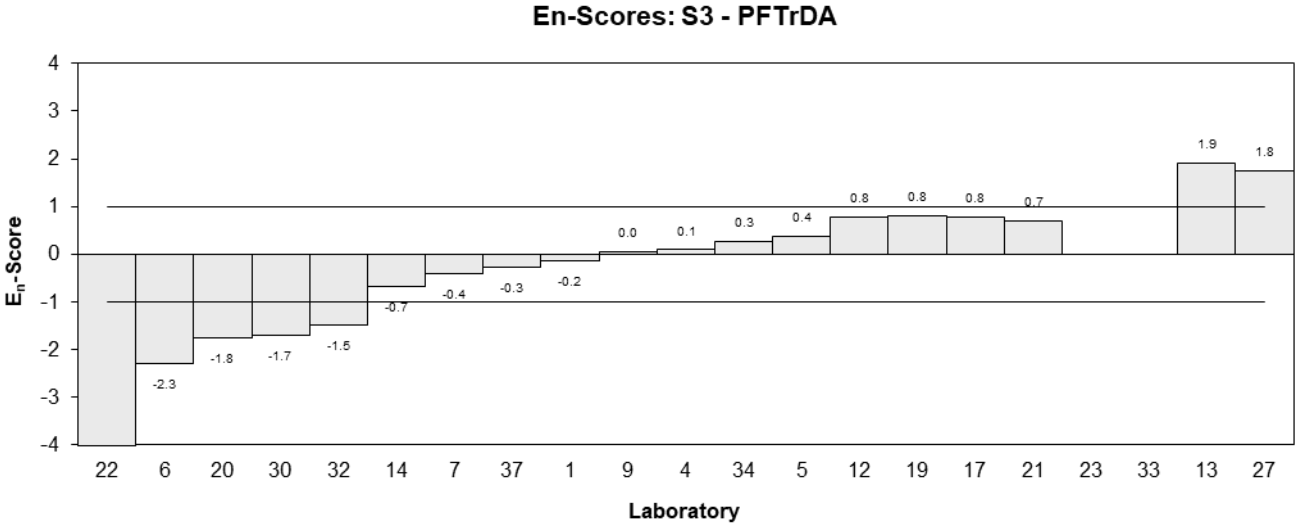

En-Scores: S3 - PFTrDA
En-Score
Laboratory
22 6 20 30 32 14 7 37 1 9 4 34 5 12 19 17 21 23 33 13 27

Figure 60

Table 64

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFTeDA |
| **Unit** | µg/kg |

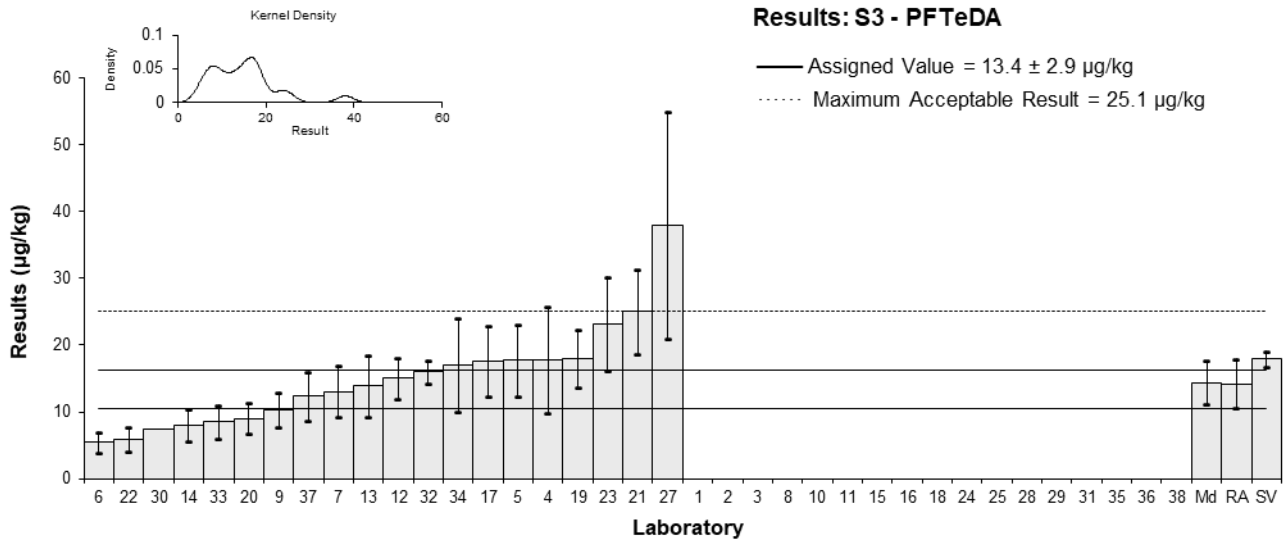
**Participant Results**

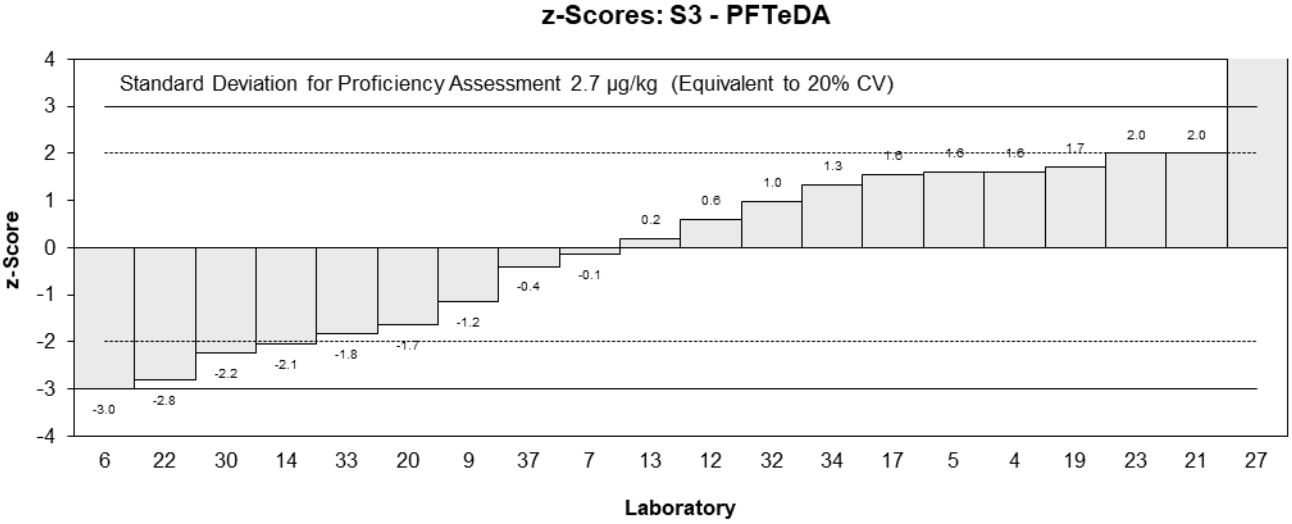
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 17.712 | 7.96 | 59 | 1.61 | 0.51 |
| **5** | 17.70834 | 5.312502 | 40 | 1.61 | 0.71 |
| **6*** | 5.4 | 1.62 | 118 | -2.99 | -2.41 |
| **7** | 13.04 | 3.9 | NR | -0.13 | -0.07 |
| **8** | NS | NS | NS | | |
| **9** | 10.3 | 2.6 | 64 | -1.16 | -0.80 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 15 | 3.0 | 103 | 0.60 | 0.38 |
| **13** | 13.88 | 4.58 | 13 | 0.18 | 0.09 |
| **14** | 7.9 | 2.4 | 86 | -2.05 | -1.46 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 17.54406 | 5.263218 | 58 | 1.55 | 0.69 |
| **18** | NT | NT | NT | | |
| **19** | 18 | 4.33 | 53 | 1.72 | 0.88 |
| **20** | 8.97 | 2.32 | 30 | -1.65 | -1.19 |
| **21*** | 25 | 6.3 | 129 | 2.00▼ | |
| **22*** | 5.88 | 1.76 | 118 | -2.81 | -2.22 |
| **23*** | 23.2 | 7 | 124 | 2.00▼ | |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 38 | 17 | NT | 9.18 | 1.43 |
| **28** | < 100 | 50 | 30 | | |
| **29** | NS | NS | NS | | |
| **30** | 7.41 | NR | NR | -2.24 | -2.07 |
| **31** | NS | NS | NS | | |
| **32** | 16 | 1.7 | NR | 0.97 | 0.77 |
| **33** | 8.50 | 2.55 | 50 | -1.83 | -1.27 |
| **34** | 17 | 7 | 166 | 1.34 | 0.48 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 12.32 | 3.696 | 114 | -0.40 | -0.23 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2; ▼ Adjusted Score, see Section 6.3

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 13.4 | 2.9 |
| **Spike Value** | 17.9 | 1.2 |
| **Robust Average** | 14.2 | 3.7 |
| **Max Acceptable Result** | 25.1 | |
| **Median** | 14.4 | 3.2 |
| **Mean** | 14.9 | |
| **N** | 20 | |
| **Max** | 38 | |
| **Min** | 5.4 | |
| **Robust SD** | 6.7 | |
| **Robust CV** | 47% | |


Kernel Density
Density
Result
Results: S3 - PFTeDA
Assigned Value = 13.4 ± 2.9 µg/kg
Maximum Acceptable Result = 25.1 µg/kg
Results (µg/kg)
Laboratory
6 22 30 14 33 20 9 37 7 13 12 32 34 17 5 4 19 23 21 27 1 2 3 8 10 11 15 16 18 24 25 28 29 31 35 36 38 Md RA SV


z-Scores: S3 - PFTeDA
Standard Deviation for Proficiency Assessment 2.7 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
-3.0 -2.8 -2.2 -2.1 -1.8 -1.7 -1.2 -0.4 -0.1 0.2 0.6 1.0 1.3 1.6 1.6 1.6 1.7 2.0 2.0
6 22 30 14 33 20 9 37 7 13 12 32 34 17 5 4 19 23 21 27

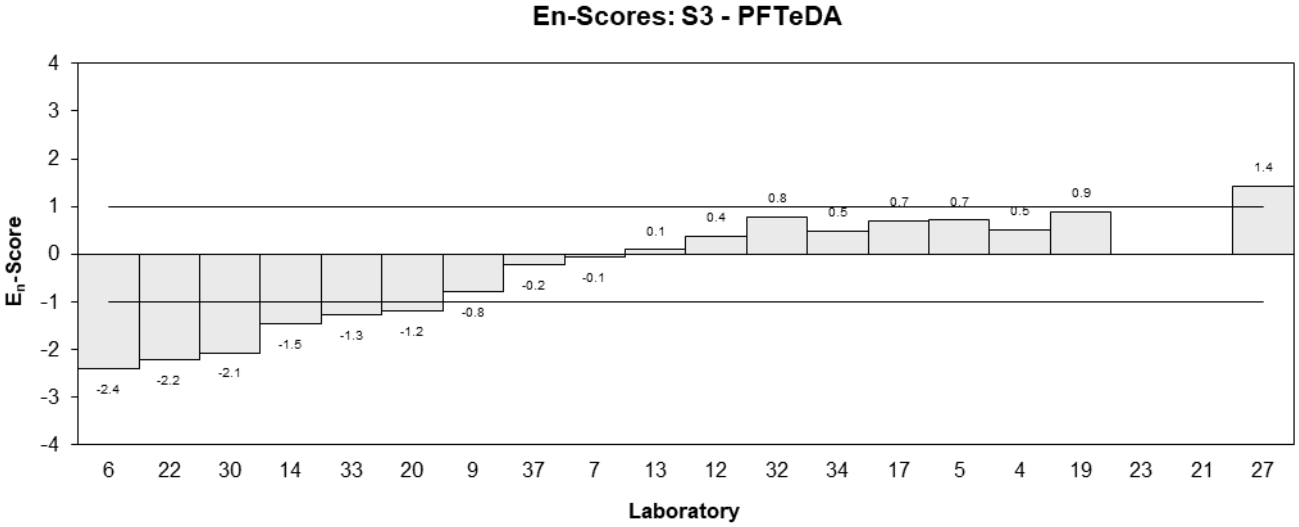

En-Scores: S3 - PFTeDA
En-Score
Laboratory
-2.4 -2.2 -2.1 -1.5 -1.3 -1.2 -0.8 -0.2 -0.1 0.1 0.4 0.8 0.5 0.7 0.7 0.5 0.9 1.4
6 22 30 14 33 20 9 37 7 13 12 32 34 17 5 4 19 23 21 27

Figure 61

Table 65

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFBS |
| **Unit** | µg/kg |

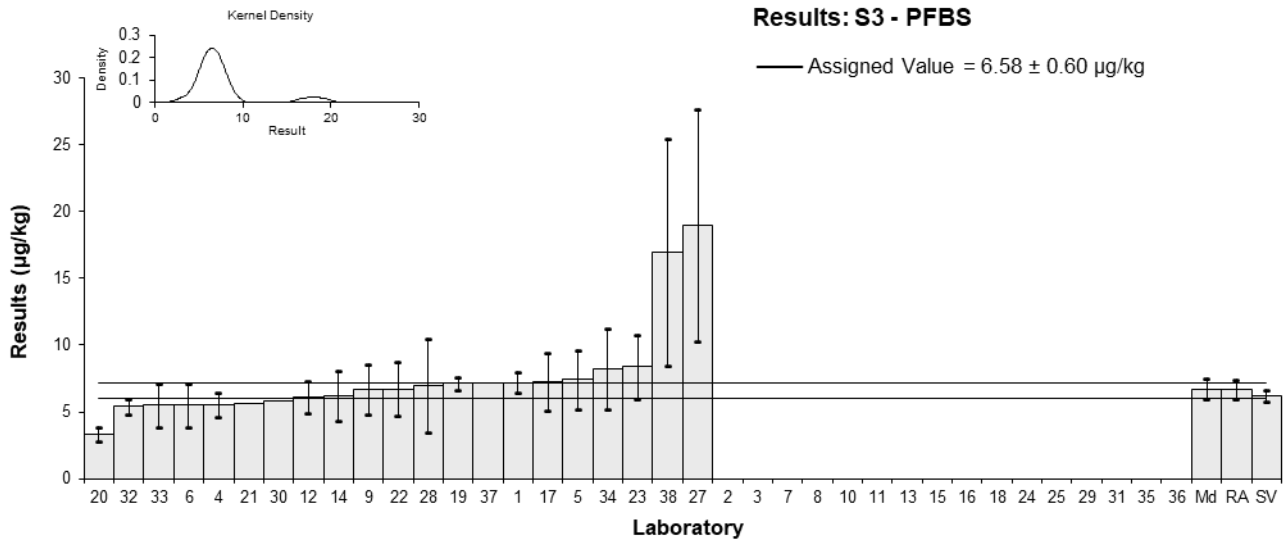
**Participant Results**

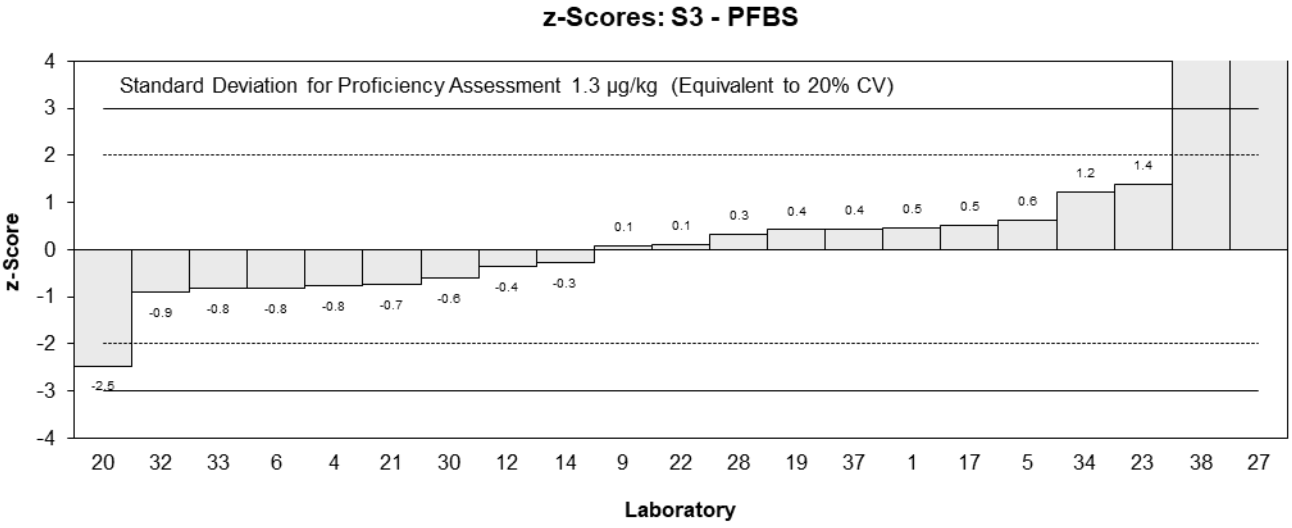
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 7.2 | 0.80 | 86 | 0.47 | 0.62 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 5.547 | 0.89 | 93 | -0.78 | -0.96 |
| **5** | 7.41029 | 2.223087 | 55 | 0.63 | 0.36 |
| **6** | 5.5 | 1.65 | 99 | -0.82 | -0.62 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | 6.7 | 1.9 | 85 | 0.09 | 0.06 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 6.1 | 1.2 | 56 | -0.36 | -0.36 |
| **13** | <5 | NR | NR | | |
| **14** | 6.2 | 1.9 | 72 | -0.29 | -0.19 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 7.245218 | 2.173565 | 29 | 0.51 | 0.30 |
| **18** | NT | NT | NT | | |
| **19** | 7.13 | 0.474 | 34 | 0.42 | 0.72 |
| **20*** | 3.33 | 0.55 | 119 | -2.47 | -3.99 |
| **21** | 5.6 | NR | 86 | -0.74 | -1.63 |
| **22** | 6.73 | 2.02 | 99 | 0.11 | 0.07 |
| **23** | 8.4 | 2.4 | 89 | 1.38 | 0.74 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 19 | 8.7 | NT | 9.44 | 1.42 |
| **28** | 7 | 3.5 | 87 | 0.32 | 0.12 |
| **29** | NS | NS | NS | | |
| **30** | 5.78 | NR | NR | -0.61 | -1.33 |
| **31** | NS | NS | NS | | |
| **32** | 5.4 | 0.59 | NR | -0.90 | -1.40 |
| **33** | 5.49 | 1.65 | 53 | -0.83 | -0.62 |
| **34** | 8.2 | 3 | 82 | 1.23 | 0.53 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 7.15 | NR | 108 | 0.43 | 0.95 |
| **38*** | 17 | 8.5 | NR | 7.92 | 1.22 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 6.58 | 0.60 |
| **Spike Value** | 6.22 | 0.44 |
| **Robust Average** | 6.71 | 0.72 |
| **Median** | 6.73 | 0.77 |
| **Mean** | 7.5 | |
| **N** | 21 | |
| **Max** | 19 | |
| **Min** | 3.33 | |
| **Robust SD** | 1.3 | |
| **Robust CV** | 20% | |


Results: S3 - PFBS
Kernel Density
Density
Result
Assigned Value = 6.58 ± 0.60 µg/kg
Results (µg/kg)
20 32 33 6 4 21 30 12 14 9 22 28 19 37 1 17 5 34 23 38 27 2 3 7 8 10 11 13 15 16 18 24 25 29 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFBS
Standard Deviation for Proficiency Assessment 1.3 µg/kg (Equivalent to 20% CV)
z-Score
-2.5 -0.9 -0.8 -0.8 -0.8 -0.7 -0.6 -0.4 -0.3 0.1 0.1 0.3 0.4 0.4 0.5 0.5 0.6 1.2 1.4
20 32 33 6 4 21 30 12 14 9 22 28 19 37 1 17 5 34 23 38 27
Laboratory

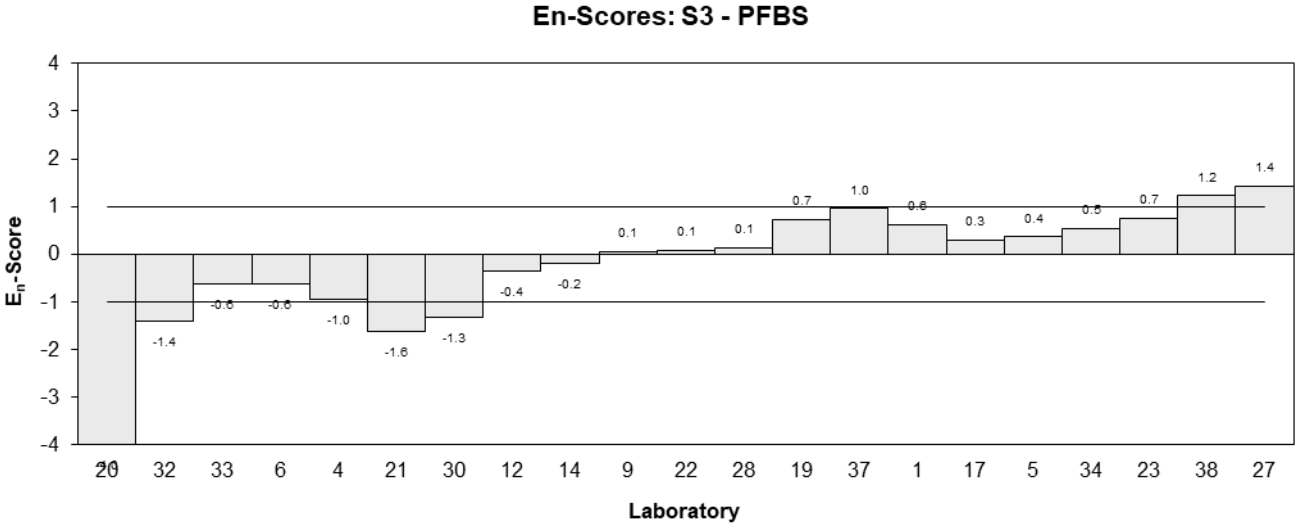

En-Scores: S3 - PFBS
En-Score
-1.4 -0.6 -0.6 -1.0 -1.6 -1.3 -0.4 -0.2 0.1 0.1 0.1 0.7 1.0 0.6 0.3 0.4 0.5 0.7 1.2 1.4
20 32 33 6 4 21 30 12 14 9 22 28 19 37 1 17 5 34 23 38 27
Laboratory

Figure 62

Table 66

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFHxS |
| **Unit** | µg/kg |

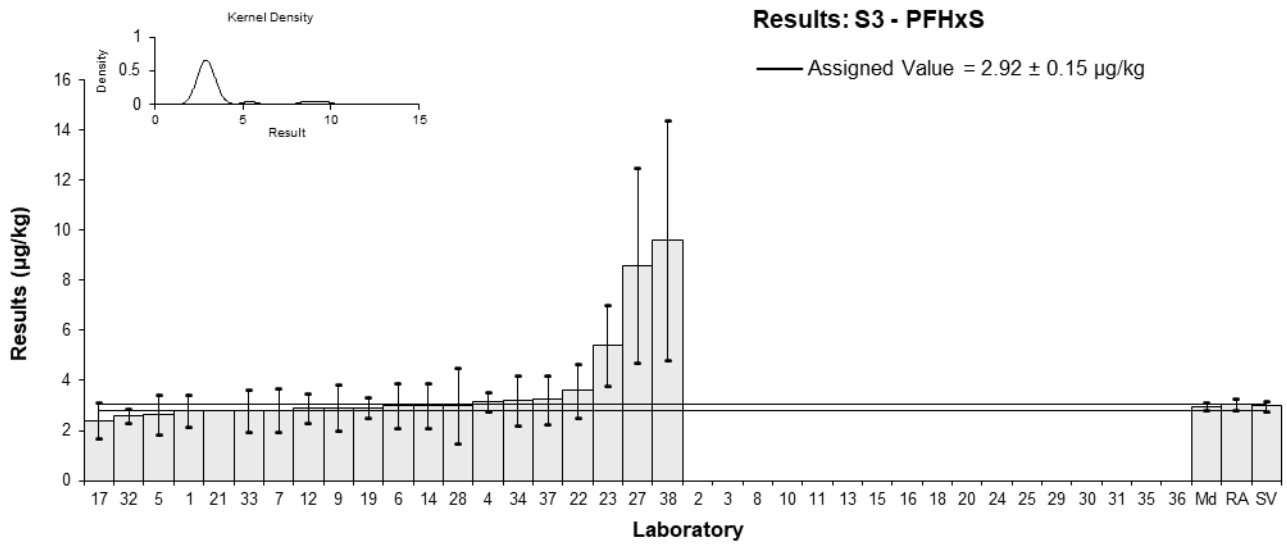
**Participant Results**

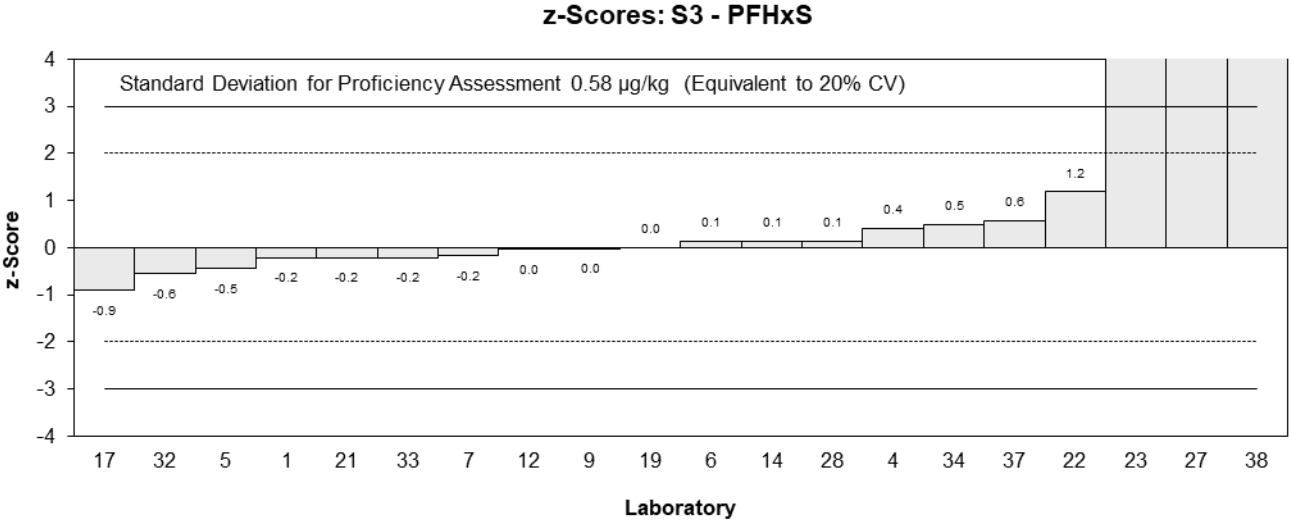
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.8 | 0.65 | 91 | -0.21 | -0.18 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 3.16 | 0.4 | 91 | 0.41 | 0.56 |
| **5** | 2.6596 | 0.79788 | 95 | -0.45 | -0.32 |
| **6** | 3.0 | 0.9 | 102 | 0.14 | 0.09 |
| **7** | 2.82 | 0.85 | NR | -0.17 | -0.12 |
| **8** | NS | NS | NS | | |
| **9** | 2.91 | 0.93 | 96 | -0.02 | -0.01 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 2.9 | 0.58 | 96 | -0.03 | -0.03 |
| **13** | <5 | NR | NR | | |
| **14** | 3 | 0.9 | 93 | 0.14 | 0.09 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 2.387625 | 0.716287 | 51 | -0.91 | -0.73 |
| **18** | NT | NT | NT | | |
| **19** | 2.92 | 0.418 | 69 | 0.00 | 0.00 |
| **20** | <2.5 | NR | 119 | | |
| **21** | 2.8 | NR | 102 | -0.21 | -0.80 |
| **22** | 3.61 | 1.08 | 102 | 1.18 | 0.63 |
| **23*** | 5.4 | 1.6 | 95 | 4.25 | 1.54 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 8.6 | 3.9 | NT | 9.73 | 1.46 |
| **28** | 3 | 1.5 | 97 | 0.14 | 0.05 |
| **29** | NS | NS | NS | | |
| **30** | NR | NR | NR | | |
| **31** | NS | NS | NS | | |
| **32** | 2.6 | 0.29 | NR | -0.55 | -0.98 |
| **33** | 2.80 | 0.84 | 55 | -0.21 | -0.14 |
| **34** | 3.2 | 1 | 92 | 0.48 | 0.28 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 3.25 | 0.975 | 114 | 0.57 | 0.33 |
| **38*** | 9.6 | 4.8 | NR | 11.44 | 1.39 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 2.92 | 0.15 |
| **Spike Value** | 2.98 | 0.21 |
| **Robust Average** | 3.04 | 0.24 |
| **Median** | 2.96 | 0.15 |
| **Mean** | 3.67 | |
| **N** | 20 | |
| **Max** | 9.6 | |
| **Min** | 2.387625 | |
| **Robust SD** | 0.42 | |
| **Robust CV** | 14% | |


Kernel Density
Density
Result
Results: S3 - PFHxS
Assigned Value = 2.92 ± 0.15 µg/kg
Results (µg/kg)
17 32 5 1 21 33 7 12 9 19 6 14 28 4 34 37 22 23 27 38 2 3 8 10 11 13 15 16 18 20 24 25 29 30 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFHxS
Standard Deviation for Proficiency Assessment 0.58 µg/kg (Equivalent to 20% CV)
z-Score
-0.9 -0.6 -0.5 -0.2 -0.2 -0.2 -0.2 0.0 0.0 0.0 0.1 0.1 0.1 0.4 0.5 0.6 1.2
17 32 5 1 21 33 7 12 9 19 6 14 28 4 34 37 22 23 27 38
Laboratory

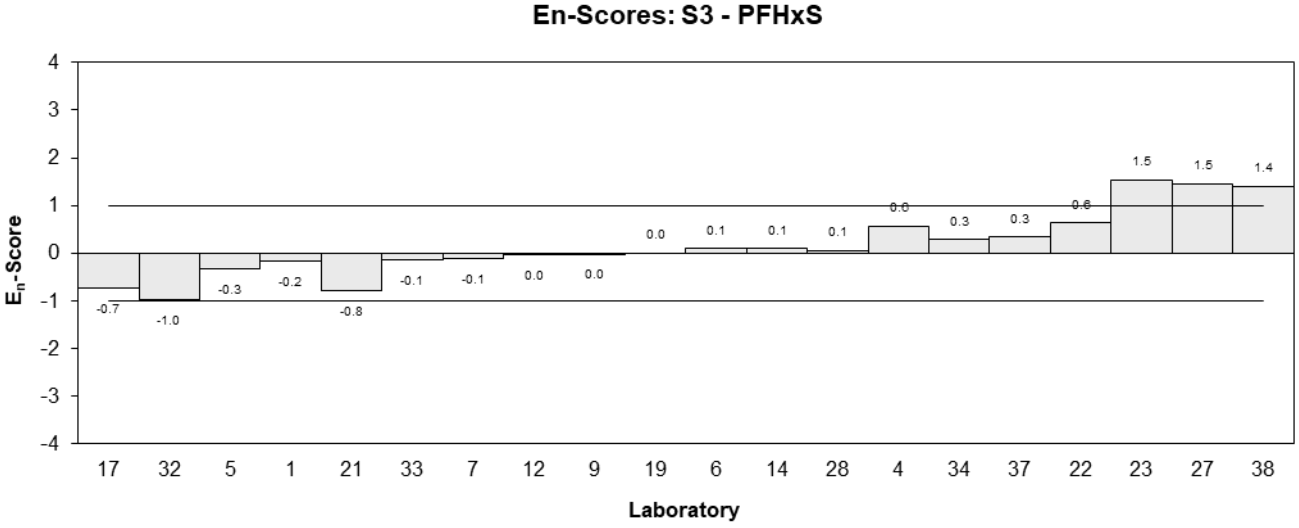

En-Scores: S3 - PFHxS
En-Score
-0.7 -1.0 -0.3 -0.2 -0.8 -0.1 -0.1 0.0 0.0 0.0 0.1 0.1 0.1 0.6 0.3 0.3 0.6 1.5 1.5 1.4
17 32 5 1 21 33 7 12 9 19 6 14 28 4 34 37 22 23 27 38
Laboratory

Figure 63

Table 67

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFHxS_L |
| **Unit** | µg/kg |

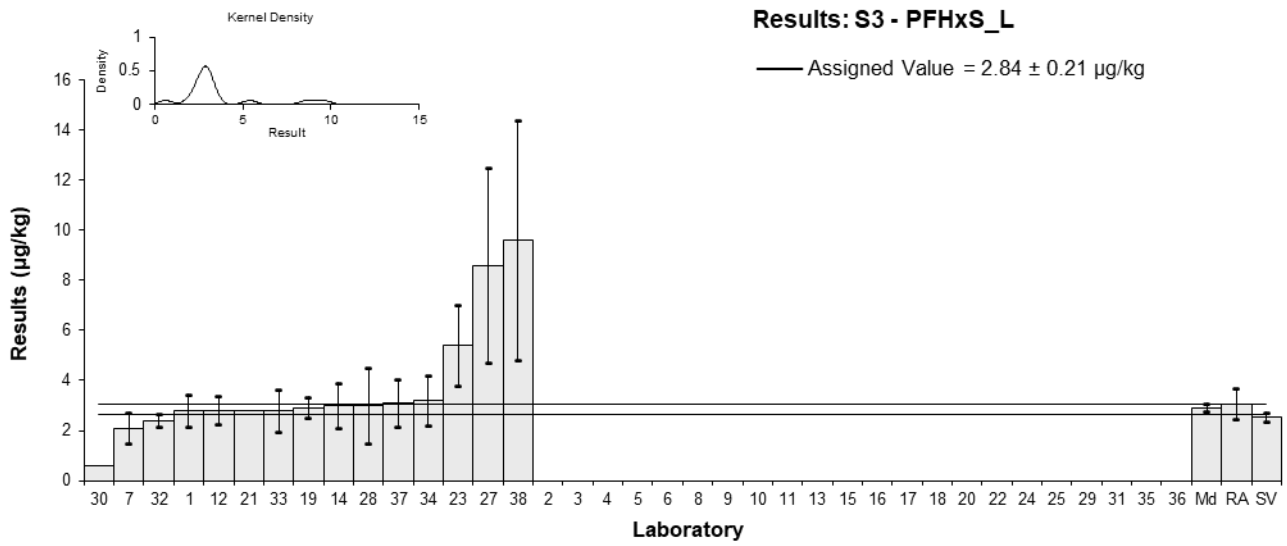
**Participant Results**

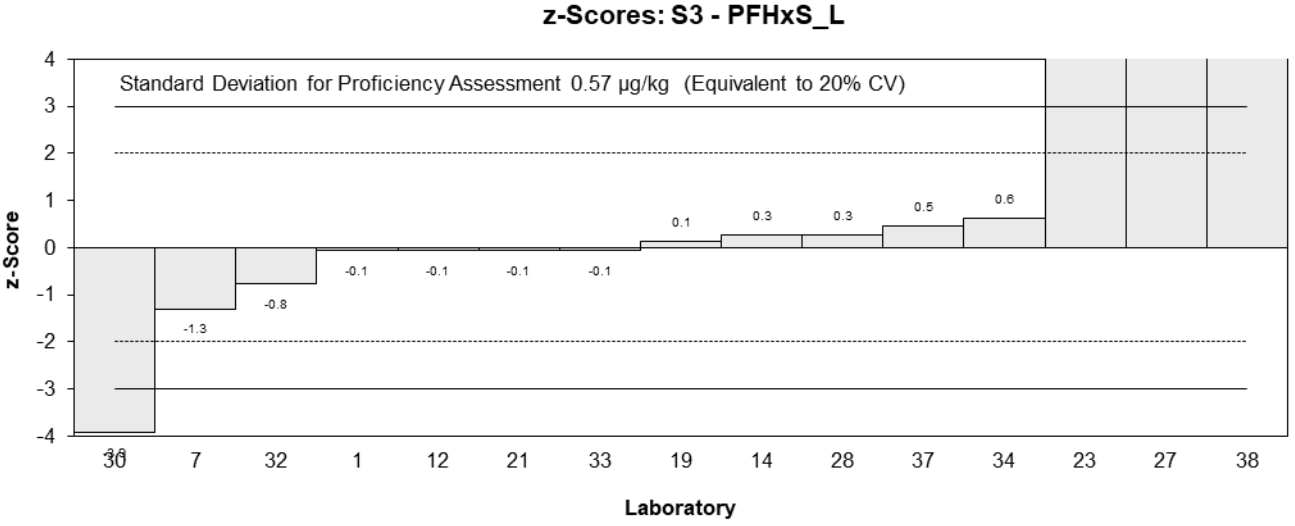
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 2.8 | 0.65 | 91 | -0.07 | -0.06 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | NT | NT | NT | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | 2.1 | 0.63 | NR | -1.30 | -1.11 |
| **8** | NS | NS | NS | | |
| **9** | NT | NT | NT | | |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 2.8 | 0.56 | NR | -0.07 | -0.07 |
| **13** | <5 | NR | NR | | |
| **14** | 3 | 0.9 | 93 | 0.28 | 0.17 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 2.92 | 0.418 | 69 | 0.14 | 0.17 |
| **20** | NT | NT | NT | | |
| **21** | 2.8 | NR | 102 | -0.07 | -0.19 |
| **22** | NT | NT | NT | | |
| **23*** | 5.4 | 1.6 | NR | 4.51 | 1.59 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 8.6 | 3.9 | NT | 10.14 | 1.47 |
| **28** | 3 | 1.5 | NR | 0.28 | 0.11 |
| **29** | NS | NS | NS | | |
| **30*** | 0.61 | NR | NR | -3.93 | -10.62 |
| **31** | NS | NS | NS | | |
| **32** | 2.4 | 0.26 | NR | -0.77 | -1.32 |
| **33** | 2.80 | 0.84 | 55 | -0.07 | -0.05 |
| **34** | 3.2 | 1 | 92 | 0.63 | 0.35 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 3.1 | 0.93 | 116 | 0.46 | 0.27 |
| **38*** | 9.6 | 4.8 | NR | 11.90 | 1.41 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 2.84 | 0.21 |
| **Spike Value** | 2.55 | 0.17 |
| **Robust Average** | 3.07 | 0.62 |
| **Median** | 2.92 | 0.17 |
| **Mean** | 3.7 | |
| **N** | 15 | |
| **Max** | 9.6 | |
| **Min** | 0.61 | |
| **Robust SD** | 0.96 | |
| **Robust CV** | 31% | |


Kernel Density
Density
Result
Results: S3 - PFHxS_L
Assigned Value = 2.84 ± 0.21 µg/kg
Results (µg/kg)
Laboratory
30 7 32 1 12 21 33 19 14 28 37 34 23 27 38 2 3 4 5 6 8 9 10 11 13 15 16 17 18 20 22 24 25 29 31 35 36 Md RA SV


z-Scores: S3 - PFHxS_L
Standard Deviation for Proficiency Assessment 0.57 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
30 7 32 1 12 21 33 19 14 28 37 34 23 27 38
-1.3 -0.8 -0.1 -0.1 -0.1 -0.1 0.1 0.3 0.3 0.5 0.6

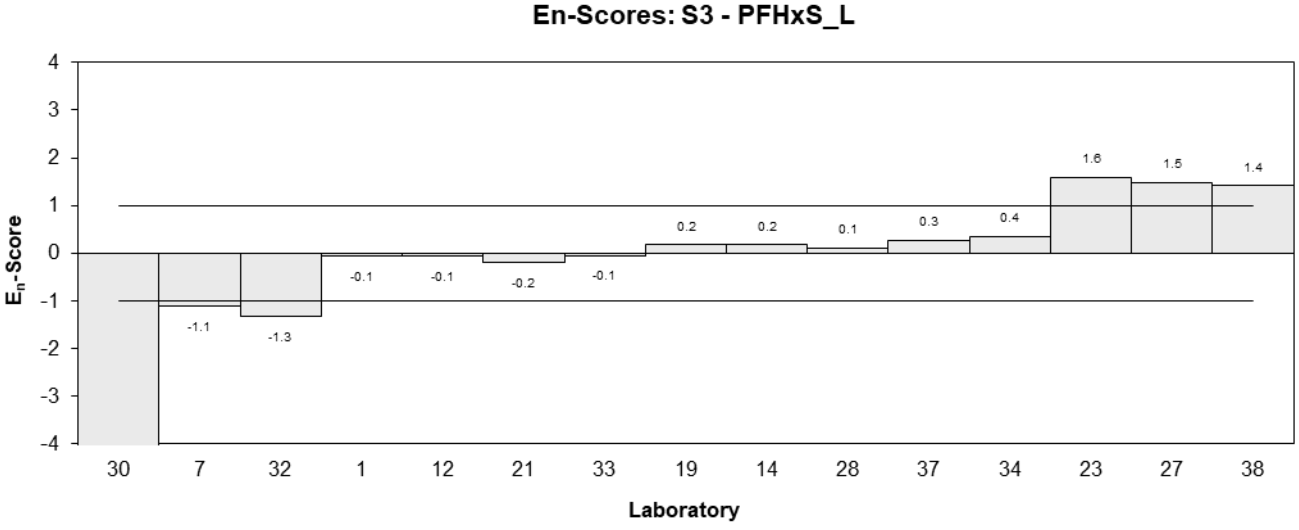

En-Scores: S3 - PFHxS_L
En-Score
Laboratory
30 7 32 1 12 21 33 19 14 28 37 34 23 27 38
-1.1 -1.3 -0.1 -0.1 -0.2 -0.1 0.2 0.2 0.1 0.3 0.4 1.6 1.5 1.4

Figure 64

Table 68

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFHpS |
| **Unit** | µg/kg |

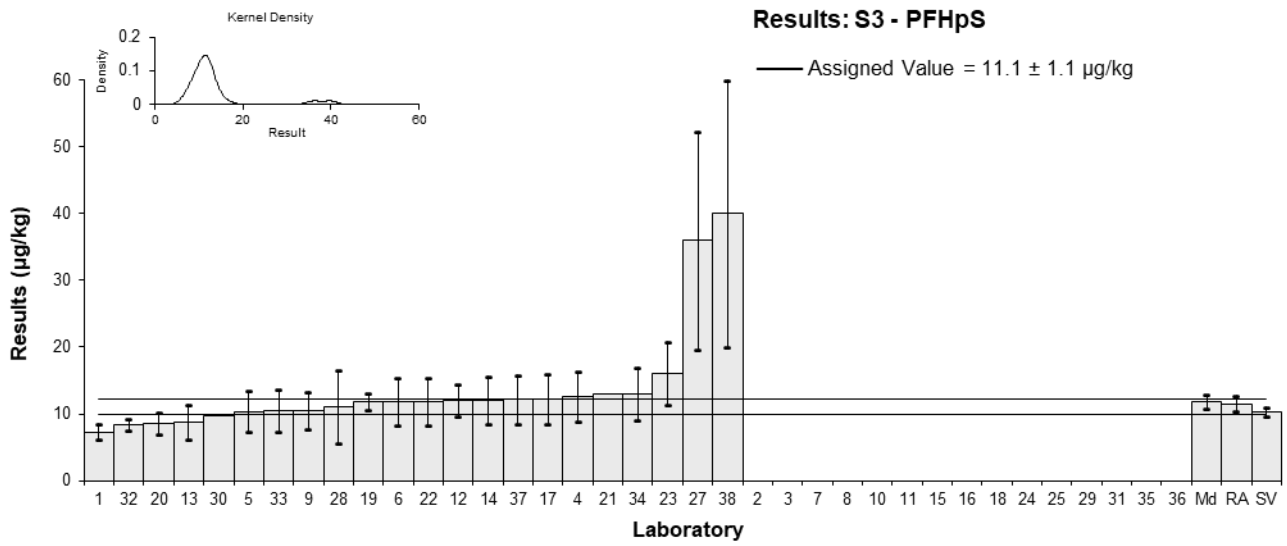
**Participant Results**

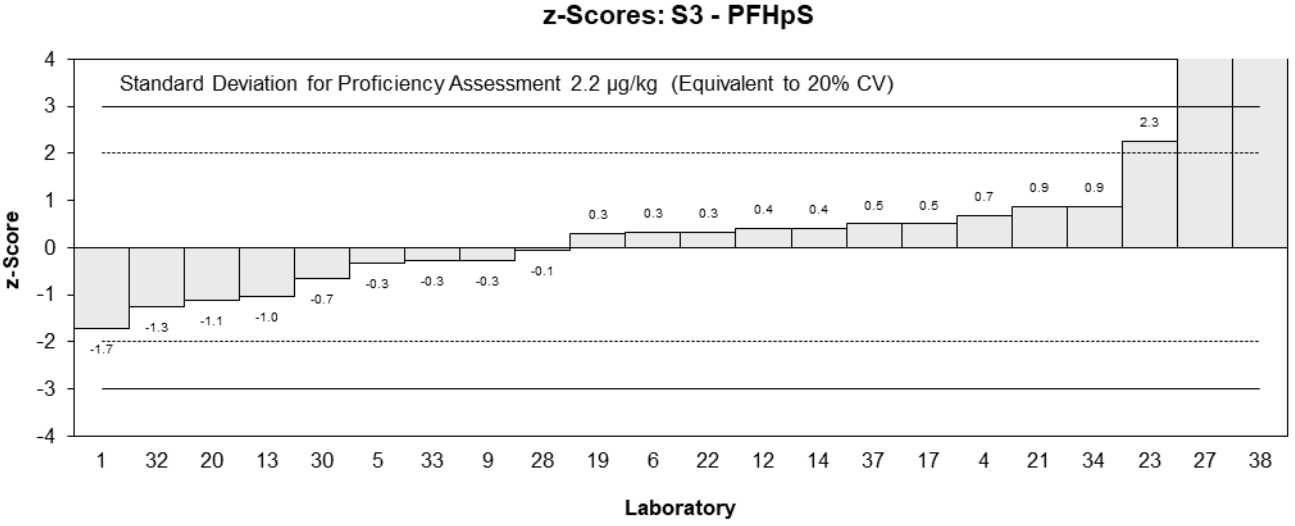
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 7.3 | 1.2 | 91 | -1.71 | -2.33 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 12.597 | 3.71 | NR | 0.67 | 0.39 |
| **5** | 10.33678 | 3.101034 | 93 | -0.34 | -0.23 |
| **6** | 11.8 | 3.54 | 118 | 0.32 | 0.19 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | 10.5 | 2.8 | 105 | -0.27 | -0.20 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 12 | 2.4 | NR | 0.41 | 0.34 |
| **13** | 8.82 | 2.62 | NR | -1.03 | -0.80 |
| **14** | 12 | 3.6 | 58 | 0.41 | 0.24 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 12.21158 | 3.663476 | 58 | 0.50 | 0.29 |
| **18** | NT | NT | NT | | |
| **19** | 11.77 | 1.22 | 69 | 0.30 | 0.41 |
| **20** | 8.61 | 1.61 | 69 | -1.12 | -1.28 |
| **21** | 13 | NR | NR | 0.86 | 1.73 |
| **22** | 11.80 | 3.54 | 118 | 0.32 | 0.19 |
| **23** | 16.1 | 4.7 | NR | 2.25 | 1.04 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 36 | 16.3 | NT | 11.22 | 1.52 |
| **28** | 11 | 5.5 | NR | -0.05 | -0.02 |
| **29** | NS | NS | NS | | |
| **30** | 9.65 | NR | NR | -0.65 | -1.32 |
| **31** | NS | NS | NS | | |
| **32** | 8.3 | 0.87 | NR | -1.26 | -2.00 |
| **33** | 10.48 | 3.14 | NR | -0.28 | -0.19 |
| **34** | 13 | 4 | 97 | 0.86 | 0.46 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 12.2 | 3.66 | NR | 0.50 | 0.29 |
| **38*** | 40 | 20 | NR | 13.02 | 1.44 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 11.1 | 1.1 |
| **Spike Value** | 10.3 | 0.7 |
| **Robust Average** | 11.5 | 1.2 |
| **Median** | 11.8 | 1.0 |
| **Mean** | 13.6 | |
| **N** | 22 | |
| **Max** | 40 | |
| **Min** | 7.3 | |
| **Robust SD** | 2.3 | |
| **Robust CV** | 20% | |


Kernel Density
Density
Result
Results: S3 - PFHpS
Assigned Value = 11.1 ± 1.1 µg/kg
Results (µg/kg)
Laboratory
1 32 20 13 30 5 33 9 28 19 6 22 12 14 37 17 4 21 34 23 27 38 2 3 7 8 10 11 15 16 18 24 25 29 31 35 36 Md RA SV


z-Scores: S3 - PFHpS
Standard Deviation for Proficiency Assessment 2.2 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
1 32 20 13 30 5 33 9 28 19 6 22 12 14 37 17 4 21 34 23 27 38

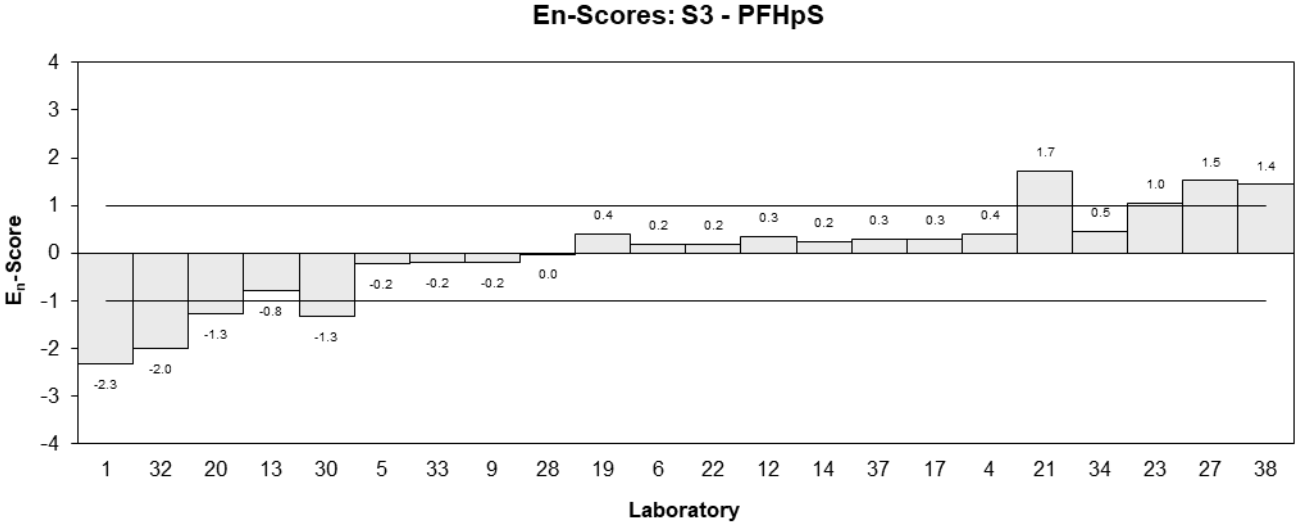

En-Scores: S3 - PFHpS
En-Score
Laboratory
1 32 20 13 30 5 33 9 28 19 6 22 12 14 37 17 4 21 34 23 27 38

Figure 65

Table 69

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFOS |
| **Unit** | µg/kg |

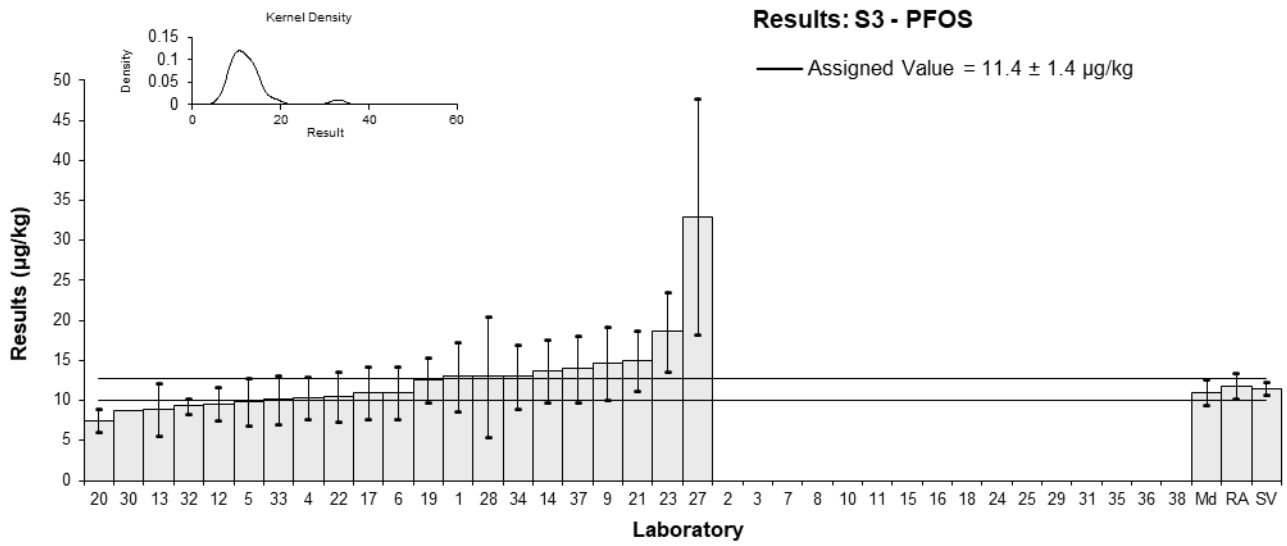
**Participant Results**

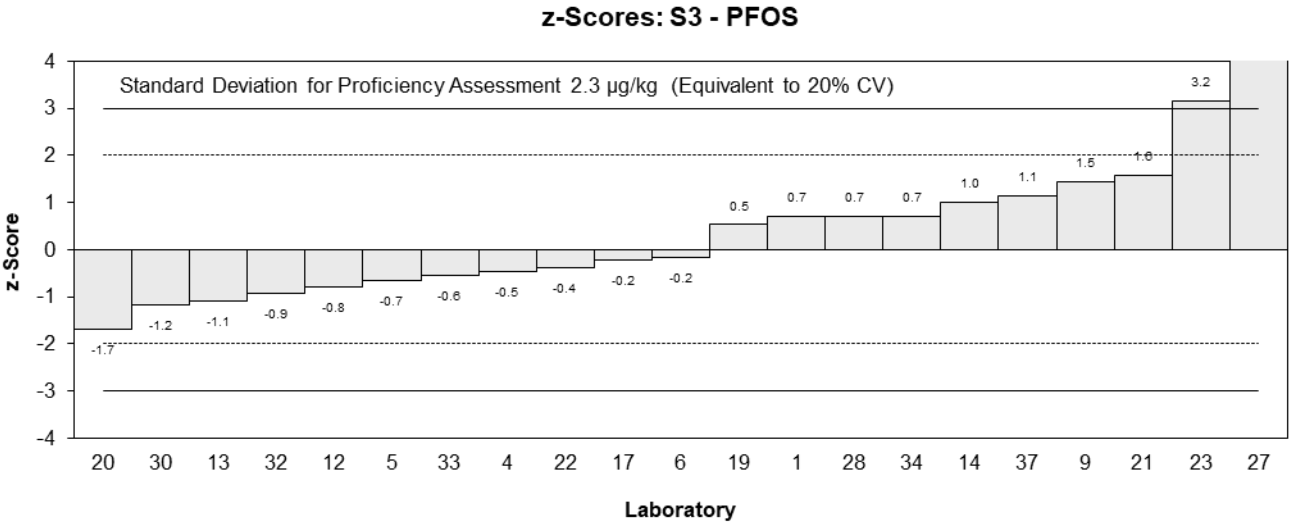
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 13 | 4.3 | 78 | 0.70 | 0.35 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 10.313 | 2.64 | 96 | -0.48 | -0.36 |
| **5** | 9.91914 | 2.975742 | 93 | -0.65 | -0.45 |
| **6** | 11 | 3.3 | 95 | -0.18 | -0.11 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | 14.7 | 4.6 | 83 | 1.45 | 0.69 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 9.6 | 2.1 | 106 | -0.79 | -0.71 |
| **13** | 8.91 | 3.3 | 106 | -1.09 | -0.69 |
| **14** | 13.7 | 3.9 | 58 | 1.01 | 0.56 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 10.90803 | 3.272410 | 58 | -0.22 | -0.14 |
| **18** | NT | NT | NT | | |
| **19** | 12.6 | 2.81 | 71 | 0.53 | 0.38 |
| **20** | 7.53 | 1.45 | 69 | -1.70 | -1.92 |
| **21** | 15 | 3.8 | 90 | 1.58 | 0.89 |
| **22** | 10.50 | 3.15 | 95 | -0.39 | -0.26 |
| **23*** | 18.6 | 5 | 93 | 3.16 | 1.39 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 33 | 14.8 | NT | 9.47 | 1.45 |
| **28** | 13 | 7.5 | 122 | 0.70 | 0.21 |
| **29** | NS | NS | NS | | |
| **30** | 8.7 | NR | NR | -1.18 | -1.93 |
| **31** | NS | NS | NS | | |
| **32** | 9.3 | 0.97 | NR | -0.92 | -1.23 |
| **33** | 10.15 | 3.05 | 86 | -0.55 | -0.37 |
| **34** | 13 | 4 | 97 | 0.70 | 0.38 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 13.97 | 4.191 | NR | 1.13 | 0.58 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 11.4 | 1.4 |
| **Spike Value** | 11.5 | 0.8 |
| **Robust Average** | 11.8 | 1.6 |
| **Median** | 11.0 | 1.6 |
| **Mean** | 12.7 | |
| **N** | 21 | |
| **Max** | 33 | |
| **Min** | 7.53 | |
| **Robust SD** | 2.9 | |
| **Robust CV** | 24% | |


Results: S3 - PFOS
Assigned Value = 11.4 ± 1.4 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
20 30 13 32 12 5 33 4 22 17 6 19 1 28 34 14 37 9 21 23 27 2 3 7 8 10 11 15 16 18 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - PFOS
Standard Deviation for Proficiency Assessment 2.3 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
20 30 13 32 12 5 33 4 22 17 6 19 1 28 34 14 37 9 21 23 27
-1.7 -1.2 -1.1 -0.9 -0.8 -0.7 -0.6 -0.5 -0.4 -0.2 -0.2 0.5 0.7 0.7 0.7 1.0 1.1 1.5 1.6 3.2

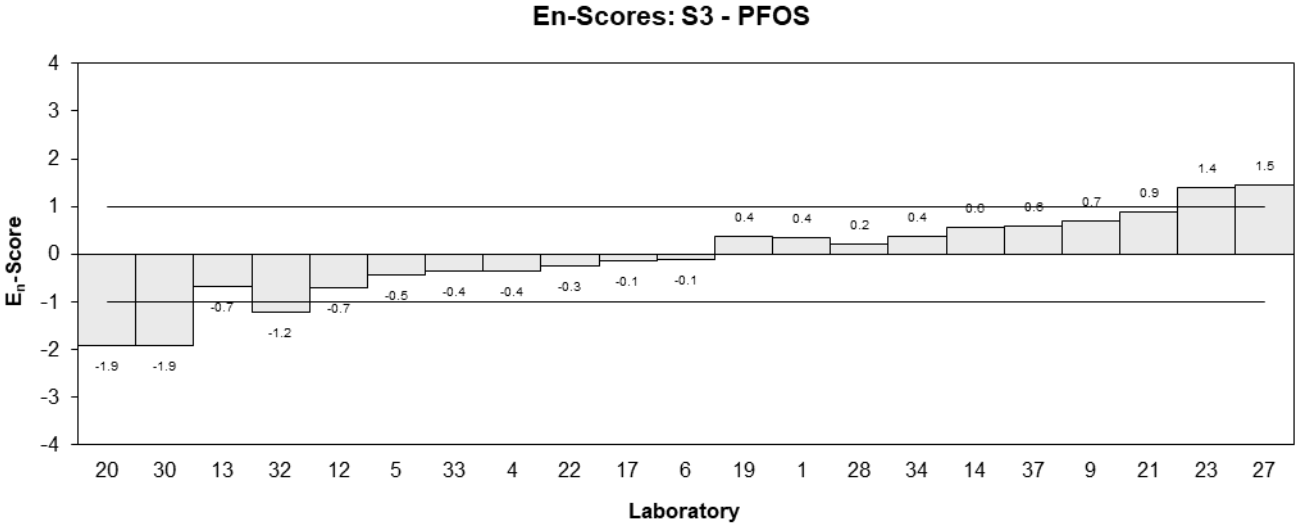

En-Scores: S3 - PFOS
En-Score
Laboratory
20 30 13 32 12 5 33 4 22 17 6 19 1 28 34 14 37 9 21 23 27
-1.9 -1.9 -0.7 -1.2 -0.7 -0.5 -0.4 -0.4 -0.3 -0.1 -0.1 0.4 0.4 0.2 0.4 0.6 0.6 0.7 0.9 1.4 1.5

Figure 66

Table 70

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFOS_L |
| **Unit** | µg/kg |

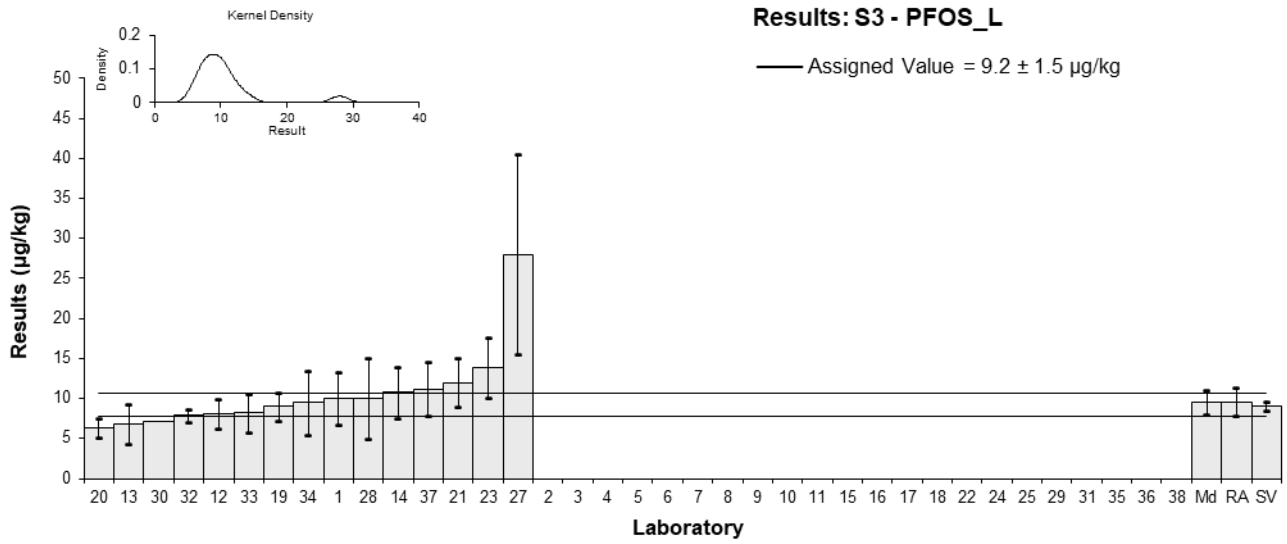
**Participant Results**

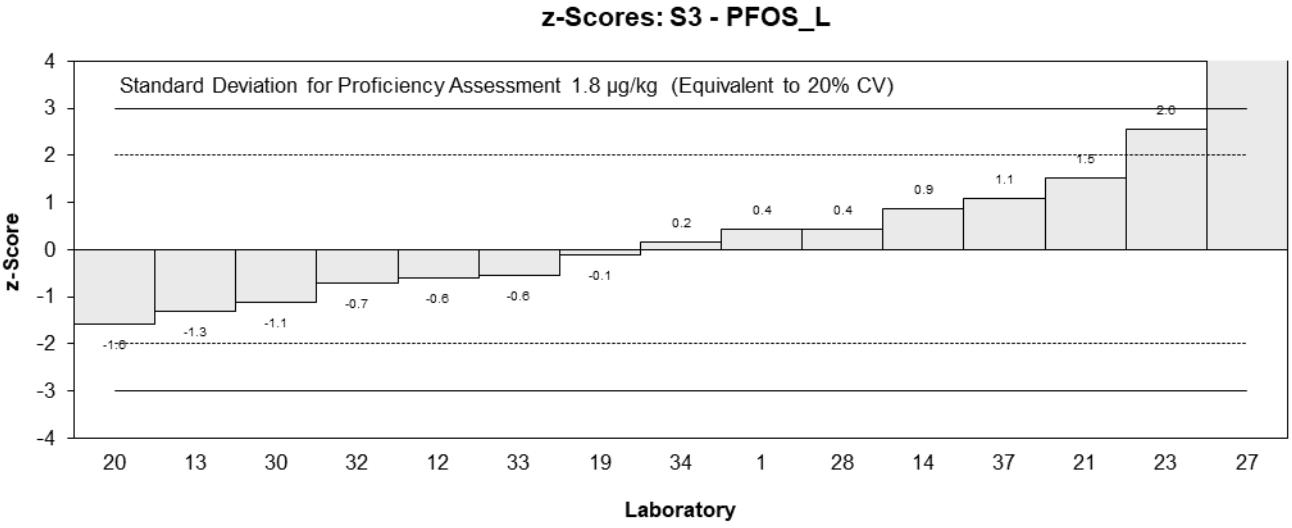
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 10 | 3.3 | 78 | 0.43 | 0.22 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | NT | NT | NT | | |
| **5** | NT | NT | NT | | |
| **6** | NT | NT | NT | | |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | NT | NT | NT | | |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 8.1 | 1.8 | NR | -0.60 | -0.47 |
| **13** | 6.77 | 2.51 | NR | -1.32 | -0.83 |
| **14** | 10.8 | 3.2 | 58 | 0.87 | 0.45 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 9 | 1.81 | 71 | -0.11 | -0.09 |
| **20** | 6.28 | 1.21 | 69 | -1.59 | -1.52 |
| **21** | 12 | 3 | 90 | 1.52 | 0.83 |
| **22** | NT | NT | NT | | |
| **23** | 13.9 | 3.8 | NR | 2.55 | 1.15 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 28 | 12.5 | NT | 10.22 | 1.49 |
| **28** | 10 | 5 | NR | 0.43 | 0.15 |
| **29** | NS | NS | NS | | |
| **30** | 7.14 | NR | NR | -1.12 | -1.37 |
| **31** | NS | NS | NS | | |
| **32** | 7.9 | 0.83 | NR | -0.71 | -0.76 |
| **33** | 8.19 | 2.46 | 86 | -0.55 | -0.35 |
| **34** | 9.5 | 4 | 97 | 0.16 | 0.07 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 11.2 | 3.36 | NR | 1.09 | 0.54 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 9.2 | 1.5 |
| **Spike Value** | 9.05 | 0.60 |
| **Robust Average** | 9.6 | 1.7 |
| **Median** | 9.5 | 1.5 |
| **Mean** | 10.6 | |
| **N** | 15 | |
| **Max** | 28 | |
| **Min** | 6.28 | |
| **Robust SD** | 2.6 | |
| **Robust CV** | 27% | |


Results: S3 - PFOS_L
Assigned Value = 9.2 ± 1.5 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
20 13 30 32 12 33 19 34 1 28 14 37 21 23 27 2 3 4 5 6 7 8 9 10 11 15 16 17 18 22 24 25 29 31 35 36 38 Md RA SV
Laboratory


z-Scores: S3 - PFOS_L
Standard Deviation for Proficiency Assessment 1.8 µg/kg (Equivalent to 20% CV)
z-Score
-1.6 -1.3 -1.1 -0.7 -0.6 -0.6 -0.1 0.2 0.4 0.4 0.9 1.1 1.5 2.6
20 13 30 32 12 33 19 34 1 28 14 37 21 23 27
Laboratory

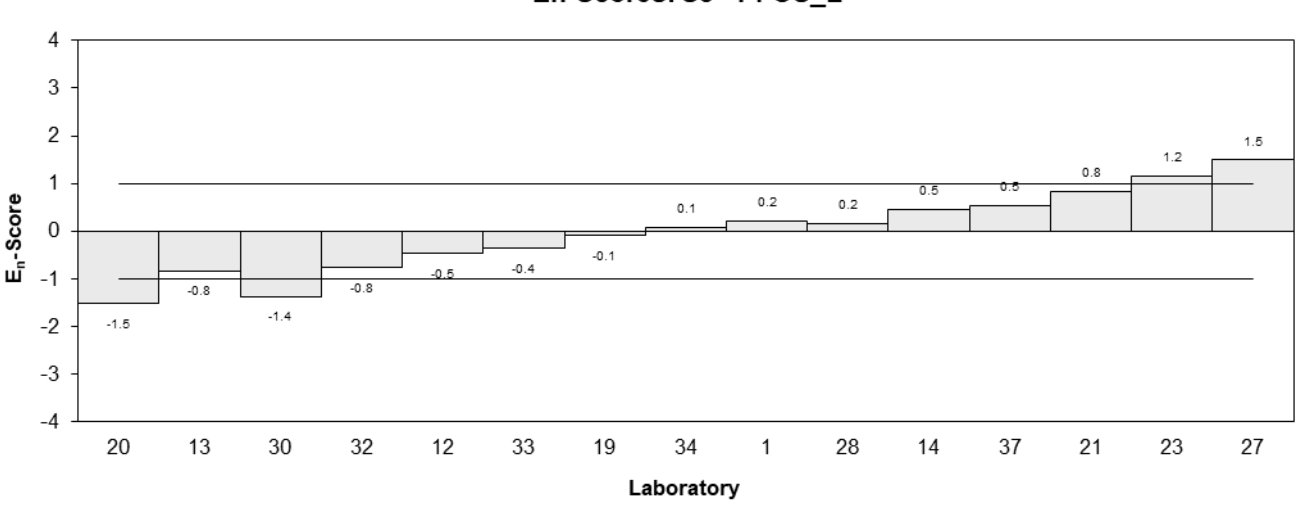

En-Scores: S3 - PFOS_L
En-Score
-1.5 -0.8 -1.4 -0.8 -0.5 -0.4 -0.1 0.1 0.2 0.2 0.5 0.5 0.8 1.2 1.5
20 13 30 32 12 33 19 34 1 28 14 37 21 23 27
Laboratory

Figure 67

Table 71

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFNS |
| **Unit** | µg/kg |

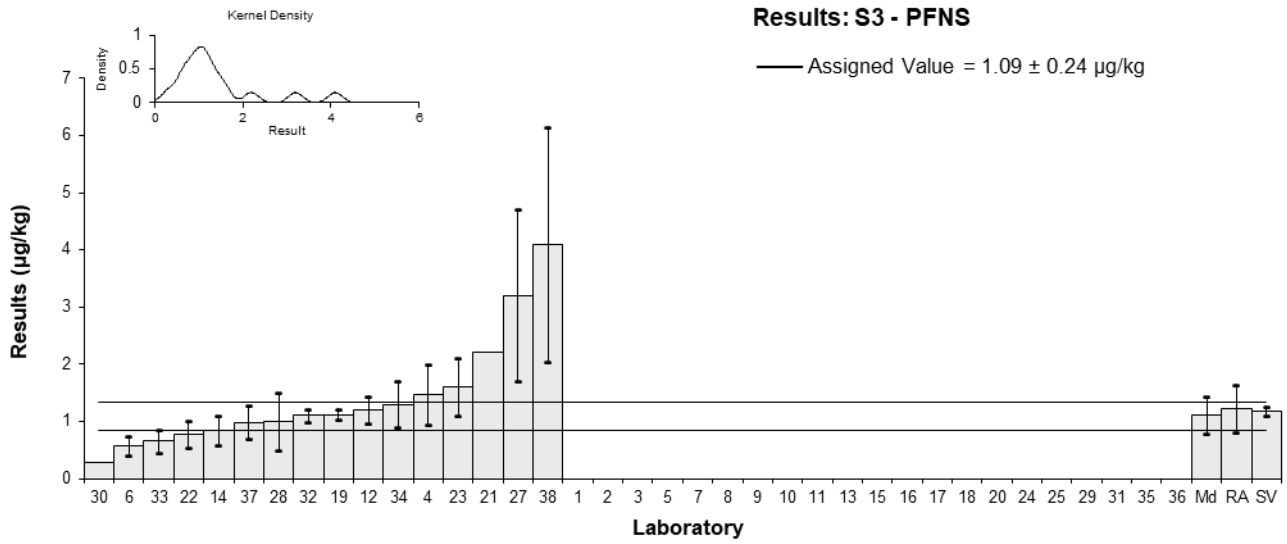
**Participant Results**

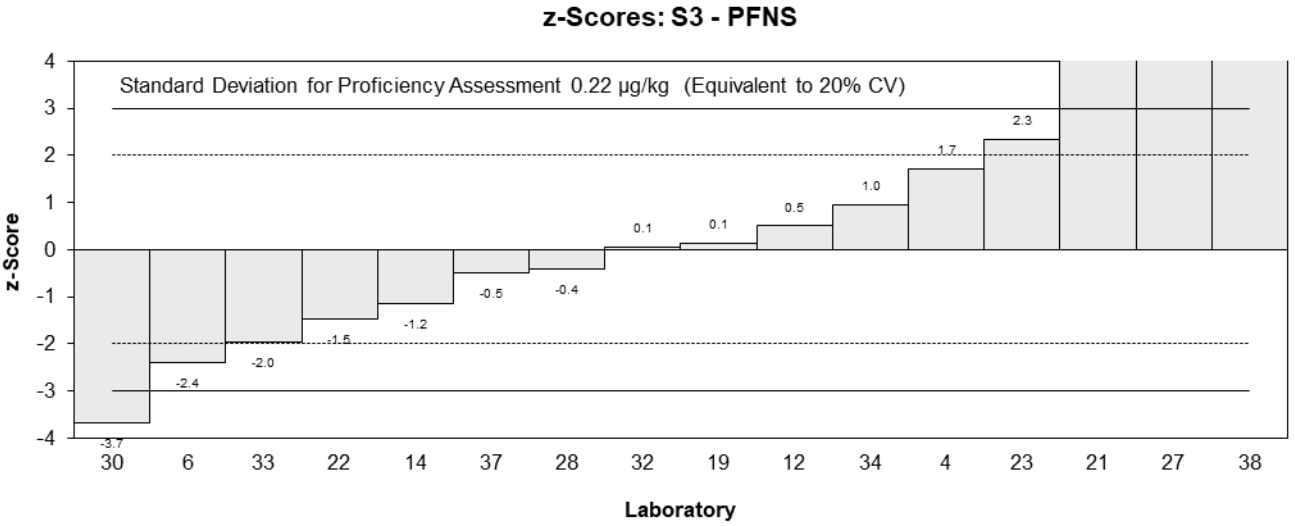
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | <5.0 | NR | 78 | | |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 1.463 | 0.53 | NR | 1.71 | 0.64 |
| **5** | NT | NT | NT | | |
| **6*** | 0.57 | 0.171 | 102 | -2.39 | -1.76 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | <2 | NR | NR | | |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 1.2 | 0.24 | NR | 0.50 | 0.32 |
| **13** | <5 | NR | NR | | |
| **14** | 0.84 | 0.252 | 58 | -1.15 | -0.72 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | NT | NT | NT | | |
| **18** | NT | NT | NT | | |
| **19** | 1.12 | 0.0988 | 71 | 0.14 | 0.12 |
| **20** | <2.5 | NR | 69 | | |
| **21*** | 2.2 | NR | NR | 5.09 | 4.63 |
| **22** | 0.77 | 0.23 | 102 | -1.47 | -0.96 |
| **23** | 1.6 | 0.5 | NR | 2.34 | 0.92 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 3.2 | 1.5 | NT | 9.68 | 1.39 |
| **28** | 1 | 0.5 | NR | -0.41 | -0.16 |
| **29** | NS | NS | NS | | |
| **30*** | 0.29 | NR | NR | -3.67 | -3.33 |
| **31** | NS | NS | NS | | |
| **32** | 1.1 | 0.12 | NR | 0.05 | 0.04 |
| **33** | 0.66 | 0.20 | NR | -1.97 | -1.38 |
| **34** | 1.3 | 0.4 | 97 | 0.96 | 0.45 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 0.98 | 0.294 | NR | -0.50 | -0.29 |
| **38*** | 4.1 | 2.05 | NR | 13.81 | 1.46 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 1.09 | 0.24 |
| **Spike Value** | 1.18 | 0.08 |
| **Robust Average** | 1.22 | 0.42 |
| **Median** | 1.11 | 0.32 |
| **Mean** | 1.40 | |
| **N** | 16 | |
| **Max** | 4.1 | |
| **Min** | 0.29 | |
| **Robust SD** | 0.67 | |
| **Robust CV** | 55% | |


Results: S3 - PFNS
Assigned Value = 1.09 ± 0.24 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
30 6 33 22 14 37 28 32 19 12 34 4 23 21 27 38 1 2 3 5 7 8 9 10 11 13 15 16 17 18 20 24 25 29 31 35 36 Md RA SV
Laboratory


z-Scores: S3 - PFNS
Standard Deviation for Proficiency Assessment 0.22 µg/kg (Equivalent to 20% CV)
z-Score
-3.7 -2.4 -2.0 -1.5 -1.2 -0.5 -0.4 0.1 0.1 0.5 1.0 1.7 2.3
30 6 33 22 14 37 28 32 19 12 34 4 23 21 27 38
Laboratory

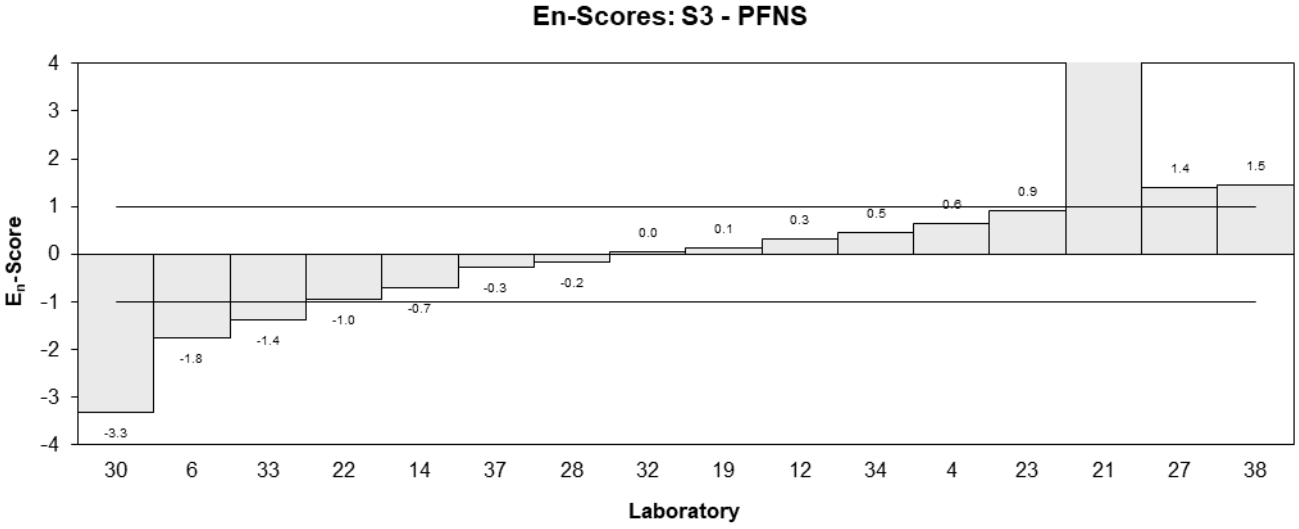

En-Scores: S3 - PFNS
En-Score
-3.3 -1.8 -1.4 -1.0 -0.7 -0.3 -0.2 0.0 0.1 0.3 0.5 0.6 0.9 1.4 1.5
30 6 33 22 14 37 28 32 19 12 34 4 23 21 27 38
Laboratory

Figure 68

Table 72

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFDS |
| **Unit** | µg/kg |

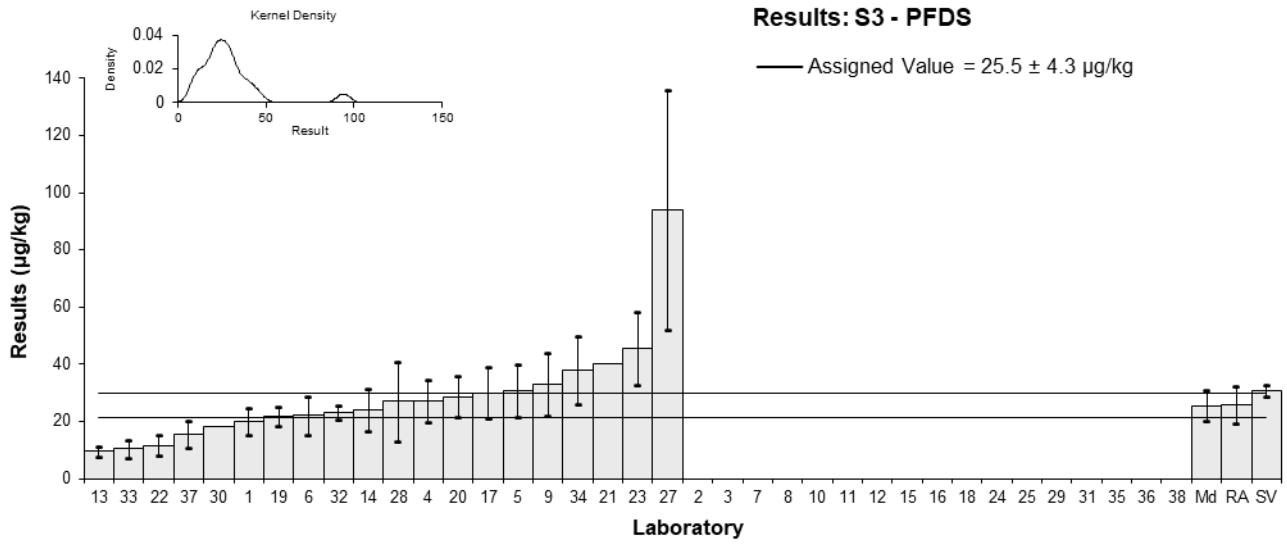
**Participant Results**

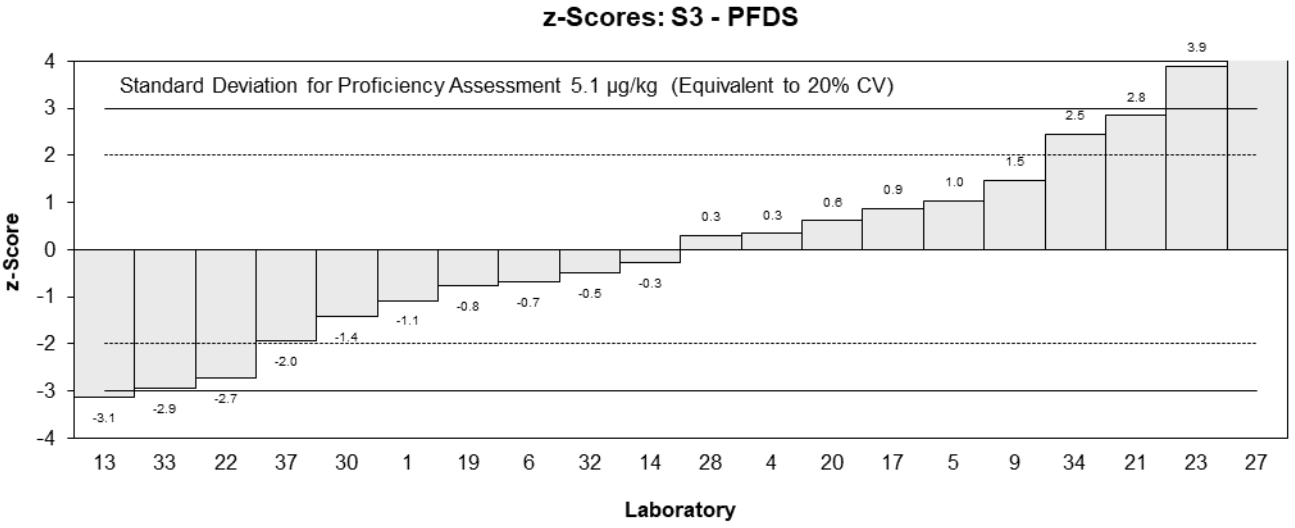
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 20 | 4.8 | 78 | -1.08 | -0.85 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 27.25 | 7.35 | NR | 0.34 | 0.21 |
| **5** | 30.81425 | 9.244275 | 93 | 1.04 | 0.52 |
| **6** | 22 | 6.6 | 69 | -0.69 | -0.44 |
| **7** | <0.1 | NR | NR | | |
| **8** | NS | NS | NS | | |
| **9** | 33 | 11 | 84 | 1.47 | 0.64 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | NR | NR | NR | | |
| **13*** | 9.53 | 1.81 | NR | -3.13 | -3.42 |
| **14** | 24 | 7.2 | 58 | -0.29 | -0.18 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 29.89830 | 8.969490 | 58 | 0.86 | 0.44 |
| **18** | NT | NT | NT | | |
| **19** | 21.6 | 3.41 | 71 | -0.76 | -0.71 |
| **20** | 28.6 | 7.15 | 69 | 0.61 | 0.37 |
| **21*** | 40 | NR | NR | 2.84 | 3.37 |
| **22*** | 11.65 | 3.49 | 69 | -2.72 | -2.50 |
| **23*** | 45.4 | 12.7 | NR | 3.90 | 1.48 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 94 | 42 | NT | 13.43 | 1.62 |
| **28** | 27 | 14 | NR | 0.29 | 0.10 |
| **29** | NS | NS | NS | | |
| **30** | 18.3 | NR | NR | -1.41 | -1.67 |
| **31** | NS | NS | NS | | |
| **32** | 23 | 2.4 | NR | -0.49 | -0.51 |
| **33*** | 10.49 | 3.15 | NR | -2.94 | -2.82 |
| **34** | 38 | 12 | 97 | 2.45 | 0.98 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 15.56 | 4.668 | NR | -1.95 | -1.57 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 25.5 | 4.3 |
| **Spike Value** | 30.7 | 2.2 |
| **Robust Average** | 25.9 | 6.5 |
| **Median** | 25.5 | 5.3 |
| **Mean** | 28.5 | |
| **N** | 20 | |
| **Max** | 94 | |
| **Min** | 9.53 | |
| **Robust SD** | 12 | |
| **Robust CV** | 45% | |


Results: S3 - PFDS
Kernel Density
Density
Result
Assigned Value = 25.5 ± 4.3 µg/kg
Results (µg/kg)
Laboratory
13 33 22 37 30 1 19 6 32 14 28 4 20 17 5 9 34 21 23 27 2 3 7 8 10 11 12 15 16 18 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - PFDS
Standard Deviation for Proficiency Assessment 5.1 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
13 33 22 37 30 1 19 6 32 14 28 4 20 17 5 9 34 21 23 27

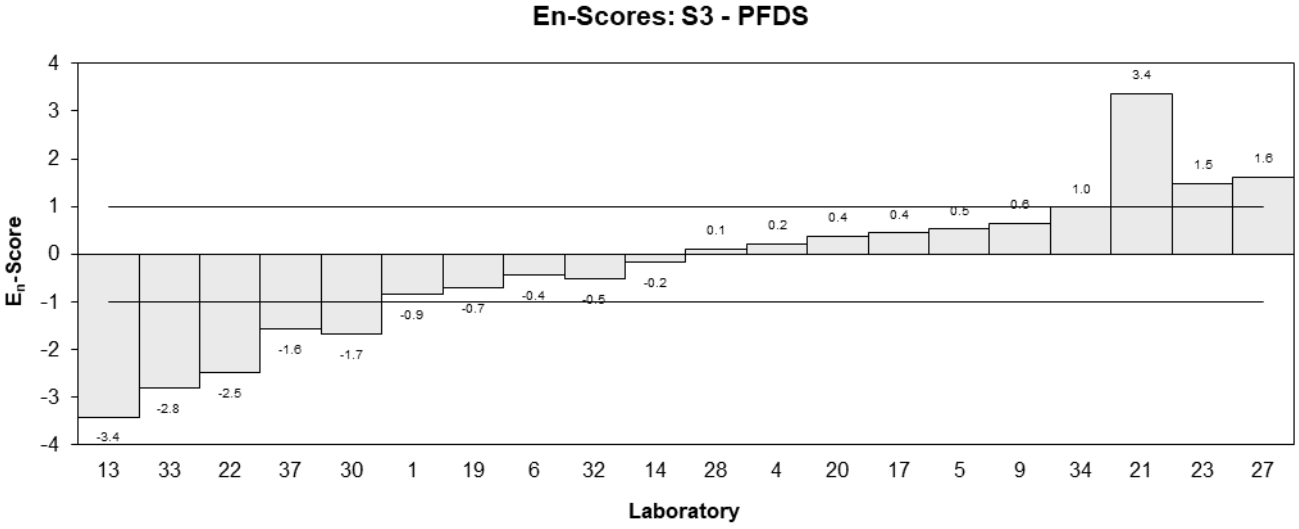

En-Scores: S3 - PFDS
En-Score
Laboratory
13 33 22 37 30 1 19 6 32 14 28 4 20 17 5 9 34 21 23 27

Figure 69

Table 73

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFDoS |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NS | NS | NS |
| **3** | NS | NS | NS |
| **4** | NT | NT | NT |
| **5** | NT | NT | NT |
| **6** | 20 | 6 | 26 |
| **7** | NT | NT | NT |
| **8** | NS | NS | NS |
| **9** | 24.7 | 6.2 | 61 |
| **10** | NS | NS | NS |
| **11** | NS | NS | NS |
| **12** | 16 | 3.2 | NR |
| **13** | 19.17 | 6.32 | NR |
| **14** | NT | NT | NT |
| **15** | NS | NS | NS |
| **16** | NS | NS | NS |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 13 | 1.14 | 71 |
| **20** | 30.3 | NR | 30 |
| **21** | 37 | NR | NR |
| **22** | 16.46 | 4.94 | 26 |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 42 | 19 | NT |
| **28** | 6 | 3 | NR |
| **29** | NS | NS | NS |
| **30** | 13.8 | NR | NR |
| **31** | NS | NS | NS |
| **32** | 16 | 1.7 | NR |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | NS | NS | NS |
| **36** | NS | NS | NS |
| **37** | NT | NT | NT |
| **38** | NT | NT | NT |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 30.9 | 2.2 |
| **Robust Average** | 20.8 | 7.9 |
| **Median** | 17.8 | 4.7 |
| **Mean** | 21.2 | |
| **N** | 12 | |
| **Max** | 42 | |
| **Min** | 6 | |
| **Robust SD** | 11 | |
| **Robust CV** | 53% | |

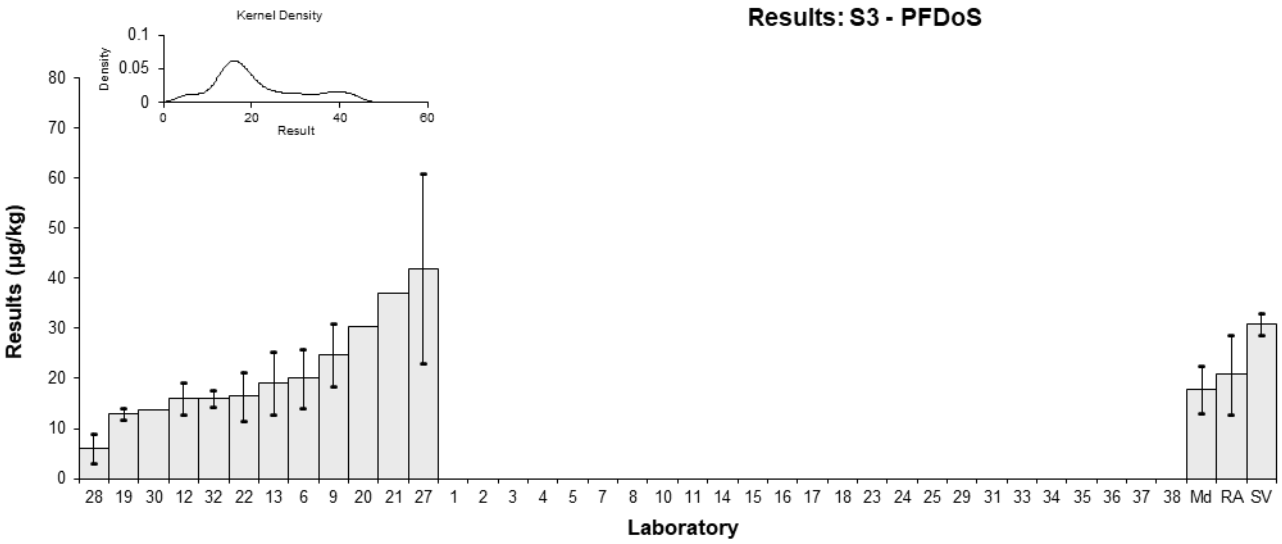

Results: S3 - PFDoS
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
28 19 30 12 32 22 13 6 9 20 21 27 1 2 3 4 5 7 8 10 11 14 15 16 17 18 23 24 25 29 31 33 34 35 36 37 38 Md RA SV

Figure 70

Table 74

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | PFOSA |
| **Unit** | µg/kg |

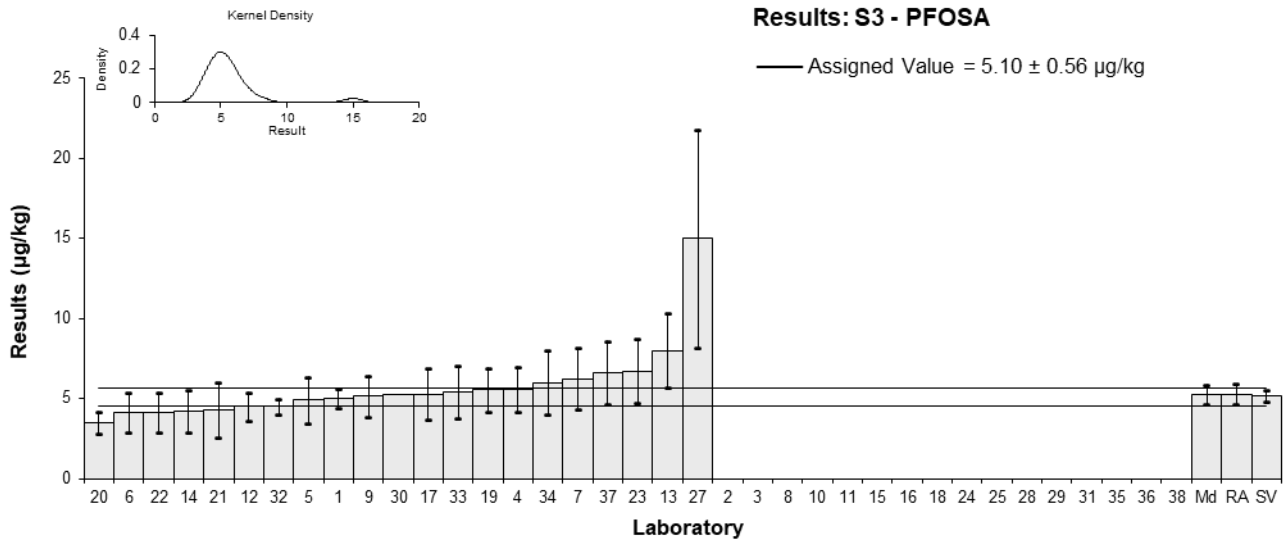
**Participant Results**

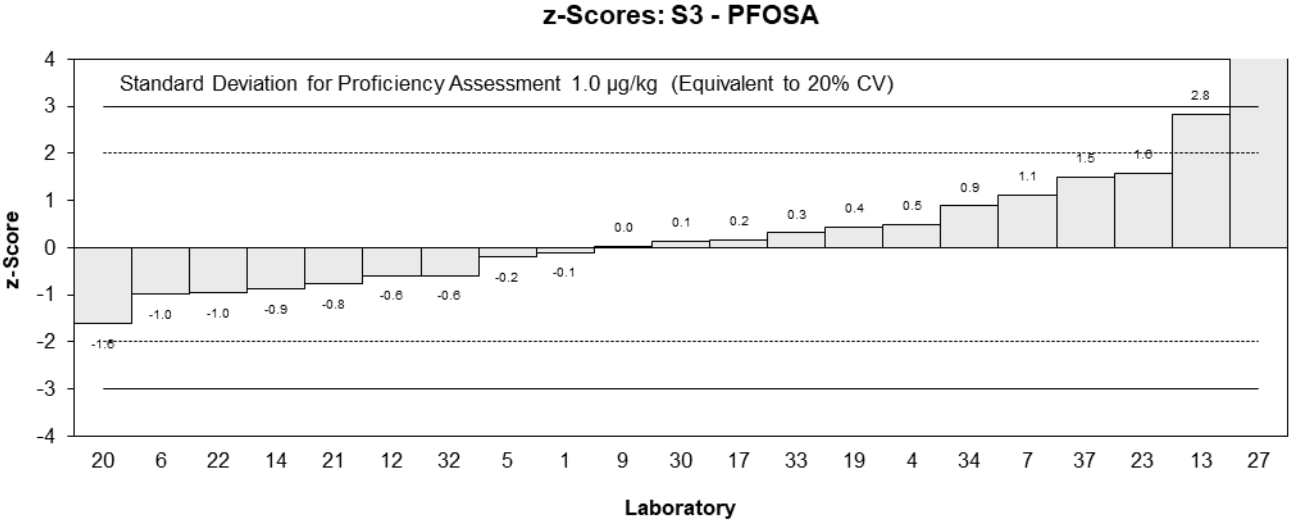
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 5 | 0.59 | 66 | -0.10 | -0.12 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 5.586 | 1.42 | 97 | 0.48 | 0.32 |
| **5** | 4.89507 | 1.468521 | 51 | -0.20 | -0.13 |
| **6** | 4.1 | 1.23 | 100 | -0.98 | -0.74 |
| **7** | 6.24 | 1.9 | NR | 1.12 | 0.58 |
| **8** | NS | NS | NS | | |
| **9** | 5.13 | 1.28 | 61 | 0.03 | 0.02 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 4.5 | 0.9 | 21 | -0.59 | -0.57 |
| **13*** | 7.99 | 2.32 | 21 | 2.83 | 1.21 |
| **14** | 4.2 | 1.3 | 65 | -0.88 | -0.64 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 5.277983 | 1.583394 | 75 | 0.17 | 0.11 |
| **18** | NT | NT | NT | | |
| **19** | 5.55 | 1.36 | 15 | 0.44 | 0.31 |
| **20** | 3.47 | 0.7 | 100 | -1.60 | -1.82 |
| **21** | 4.3 | 1.7 | 99 | -0.78 | -0.45 |
| **22** | 4.13 | 1.24 | 100 | -0.95 | -0.71 |
| **23** | 6.7 | 2 | NR | 1.57 | 0.77 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 15 | 6.8 | NT | 9.71 | 1.45 |
| **28** | < 100 | NR | 100 | | |
| **29** | NS | NS | NS | | |
| **30** | 5.24 | NR | NR | 0.14 | 0.25 |
| **31** | NS | NS | NS | | |
| **32** | 4.5 | 0.50 | NR | -0.59 | -0.80 |
| **33** | 5.42 | 1.63 | 61 | 0.31 | 0.19 |
| **34** | 6 | 2 | 86 | 0.88 | 0.43 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 6.62 | 1.986 | 101 | 1.49 | 0.74 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 5.10 | 0.56 |
| **Spike Value** | 5.15 | 0.36 |
| **Robust Average** | 5.28 | 0.63 |
| **Median** | 5.24 | 0.61 |
| **Mean** | 5.7 | |
| **N** | 21 | |
| **Max** | 15 | |
| **Min** | 3.47 | |
| **Robust SD** | 1.2 | |
| **Robust CV** | 22% | |


Results: S3 - PFOSA
Kernel Density
Density
Result
Assigned Value = 5.10 ± 0.56 µg/kg
Results (µg/kg)
20 6 22 14 21 12 32 5 1 9 30 17 33 19 4 34 7 37 23 13 27 2 3 8 10 11 15 16 18 24 25 28 29 31 35 36 38 Md RA SV
Laboratory


z-Scores: S3 - PFOSA
Standard Deviation for Proficiency Assessment 1.0 µg/kg (Equivalent to 20% CV)
z-Score
-1.6 -1.0 -1.0 -0.9 -0.8 -0.6 -0.6 -0.2 -0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.9 1.1 1.5 1.6 2.8
20 6 22 14 21 12 32 5 1 9 30 17 33 19 4 34 7 37 23 13 27
Laboratory

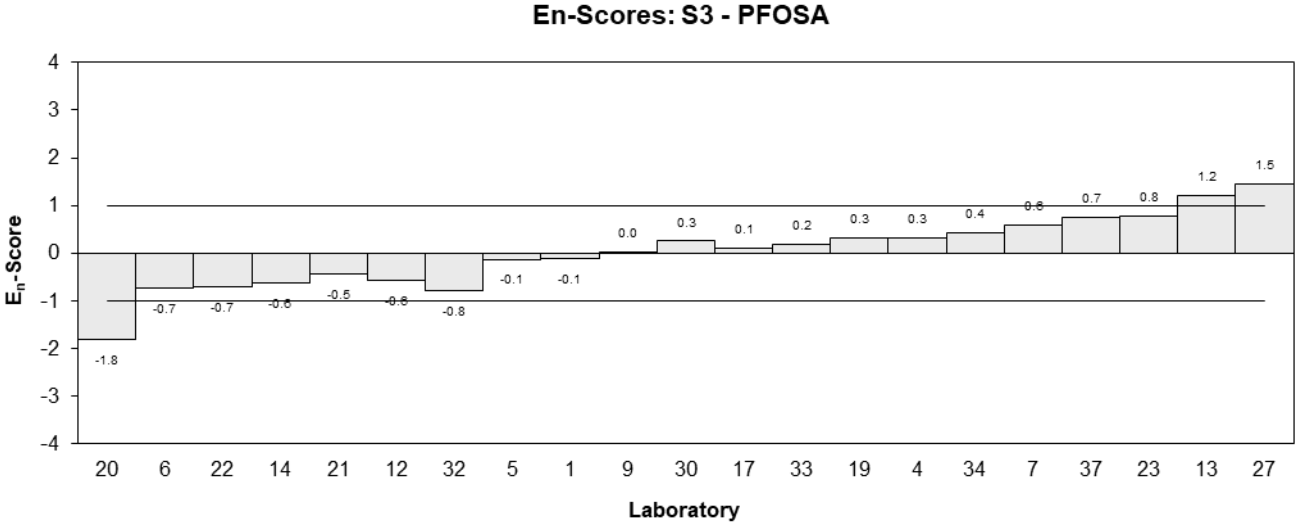

En-Scores: S3 - PFOSA
En-Score
-1.8 -0.7 -0.7 -0.6 -0.5 -0.6 -0.8 -0.1 -0.1 0.0 0.3 0.1 0.2 0.3 0.3 0.4 0.6 0.7 0.8 1.2 1.5
20 6 22 14 21 12 32 5 1 9 30 17 33 19 4 34 7 37 23 13 27
Laboratory

Figure 71

Table 75

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | EtFOSAA |
| **Unit** | µg/kg |

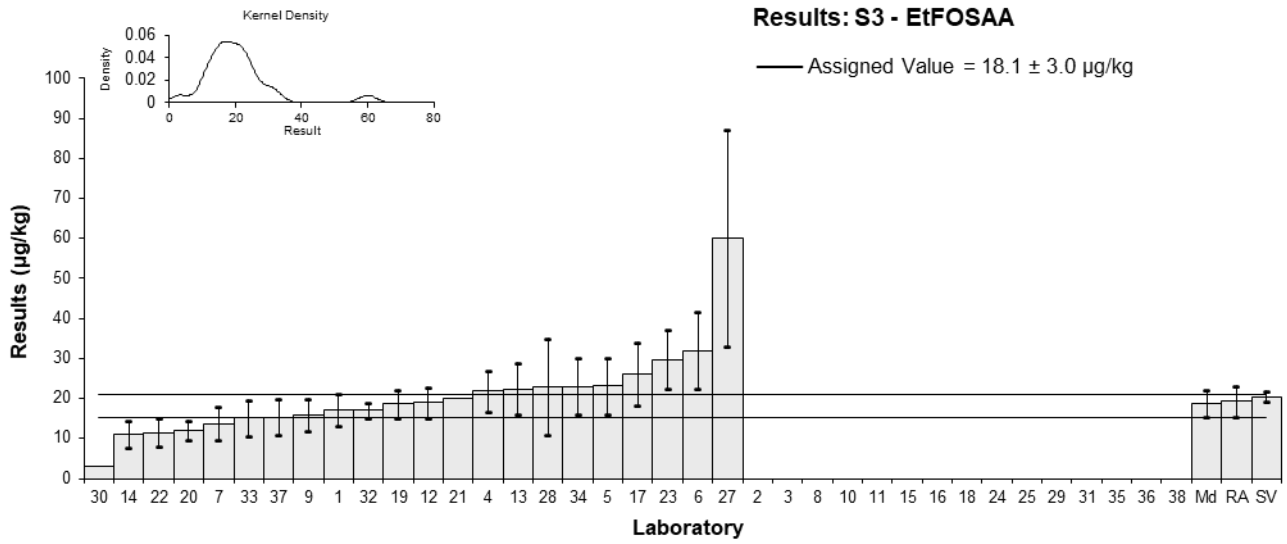
**Participant Results**

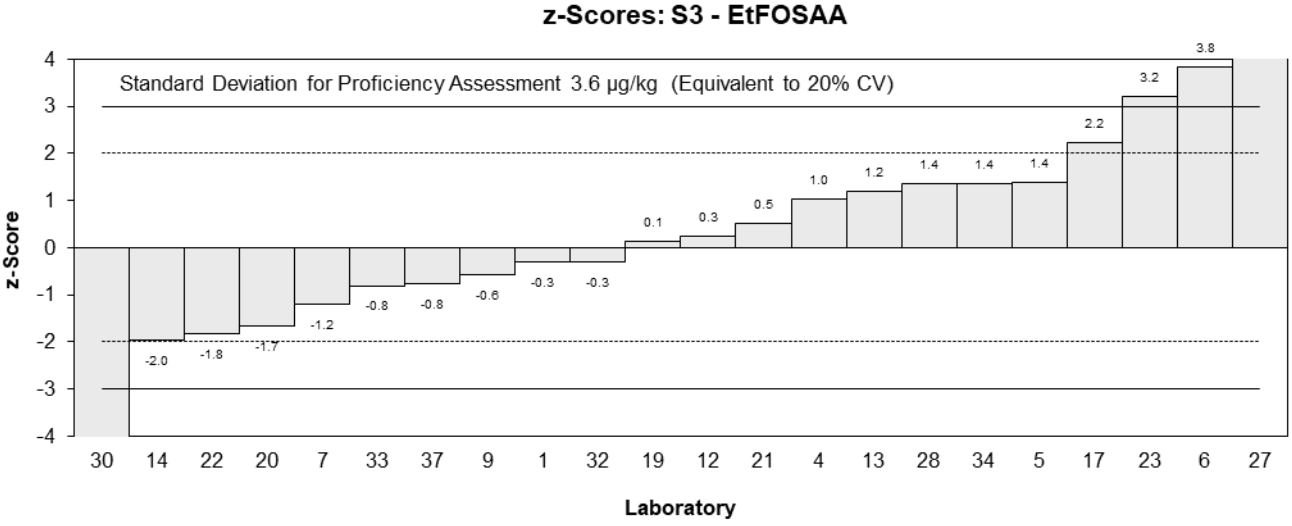
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 17 | 4.0 | 100 | -0.30 | -0.22 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 21.863 | 5.05 | 127 | 1.04 | 0.64 |
| **5** | 23.10887 | 6.932661 | 64 | 1.38 | 0.66 |
| **6*** | 32 | 9.6 | 68 | 3.84 | 1.38 |
| **7** | 13.76 | 4.1 | NR | -1.20 | -0.85 |
| **8** | NS | NS | NS | | |
| **9** | 16.0 | 4.0 | 43 | -0.58 | -0.42 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 19 | 3.8 | 27 | 0.25 | 0.19 |
| **13** | 22.39 | 6.49 | 20 | 1.19 | 0.60 |
| **14** | 11 | 3.3 | 55 | -1.96 | -1.59 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 26.18771 | 7.856314 | 77 | 2.23 | 0.96 |
| **18** | NT | NT | NT | | |
| **19** | 18.6 | 3.56 | 45 | 0.14 | 0.11 |
| **20** | 12.06 | 2.49 | 87 | -1.67 | -1.55 |
| **21** | 20 | NR | 94 | 0.52 | 0.63 |
| **22** | 11.47 | 3.44 | 68 | -1.83 | -1.45 |
| **23*** | 29.7 | 7.4 | 125 | 3.20 | 1.45 |
| **24** | NT | NT | NT | | |
| **25** | <5 | NR | NR | | |
| **27*** | 60 | 27 | NT | 11.57 | 1.54 |
| **28** | 23 | 12 | 216 | 1.35 | 0.40 |
| **29** | NS | NS | NS | | |
| **30*** | 3.15 | NR | NR | -4.13 | -4.98 |
| **31** | NS | NS | NS | | |
| **32** | 17 | 1.8 | NR | -0.30 | -0.31 |
| **33** | 15.16 | 4.55 | 65 | -0.81 | -0.54 |
| **34** | 23 | 7 | 139 | 1.35 | 0.64 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 15.35 | 4.605 | 112 | -0.76 | -0.50 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 18.1 | 3.0 |
| **Spike Value** | 20.5 | 1.4 |
| **Robust Average** | 19.3 | 3.8 |
| **Median** | 18.8 | 3.3 |
| **Mean** | 20.5 | |
| **N** | 22 | |
| **Max** | 60 | |
| **Min** | 3.15 | |
| **Robust SD** | 7.1 | |
| **Robust CV** | 37% | |


Kernel Density
Density
Result
Results: S3 - EtFOSAA
Assigned Value = 18.1 ± 3.0 µg/kg
Results (µg/kg)
Laboratory
30 14 22 20 7 33 37 9 1 32 19 12 21 4 13 28 34 5 17 23 6 27 2 3 8 10 11 15 16 18 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - EtFOSAA
Standard Deviation for Proficiency Assessment 3.6 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
30 14 22 20 7 33 37 9 1 32 19 12 21 4 13 28 34 5 17 23 6 27

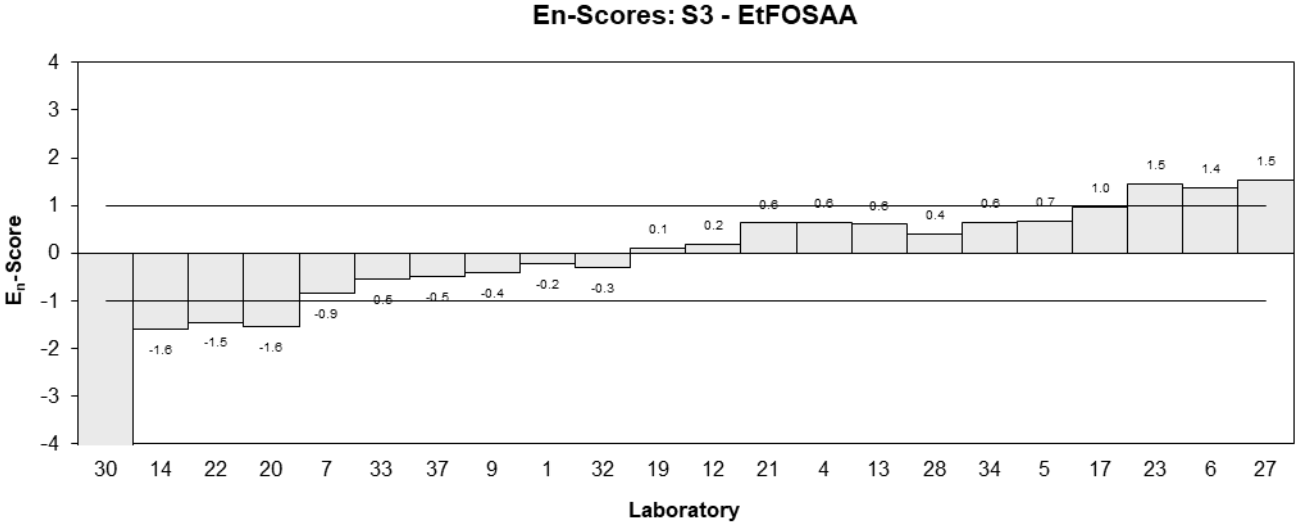

En-Scores: S3 - EtFOSAA
En-Score
Laboratory
30 14 22 20 7 33 37 9 1 32 19 12 21 4 13 28 34 5 17 23 6 27

Figure 72

Table 76

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | 6:2FTS |
| **Unit** | µg/kg |

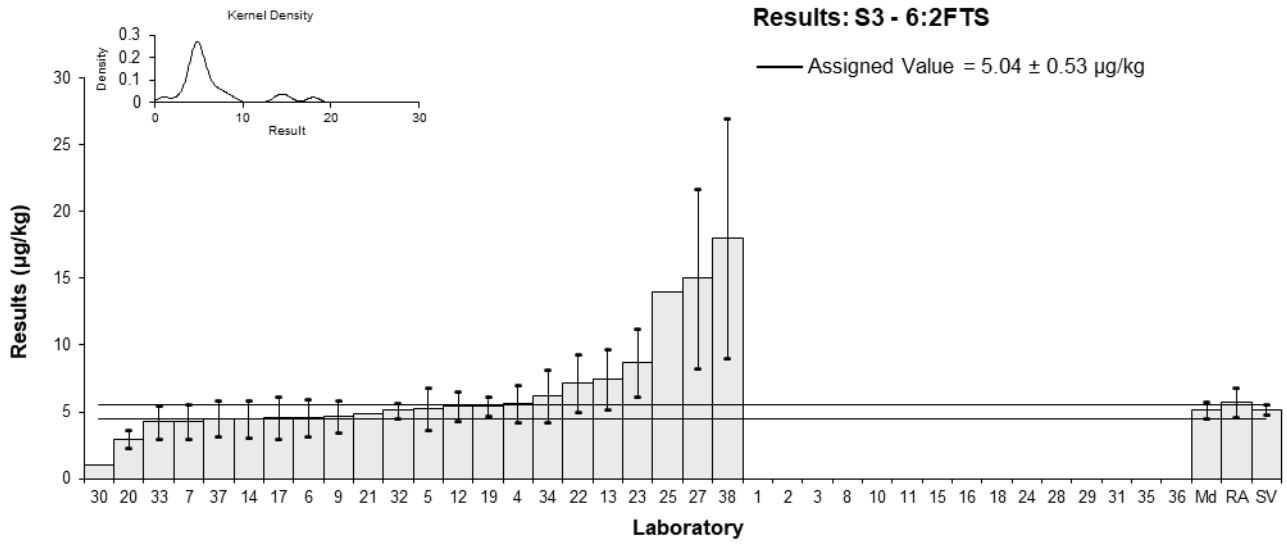
**Participant Results**

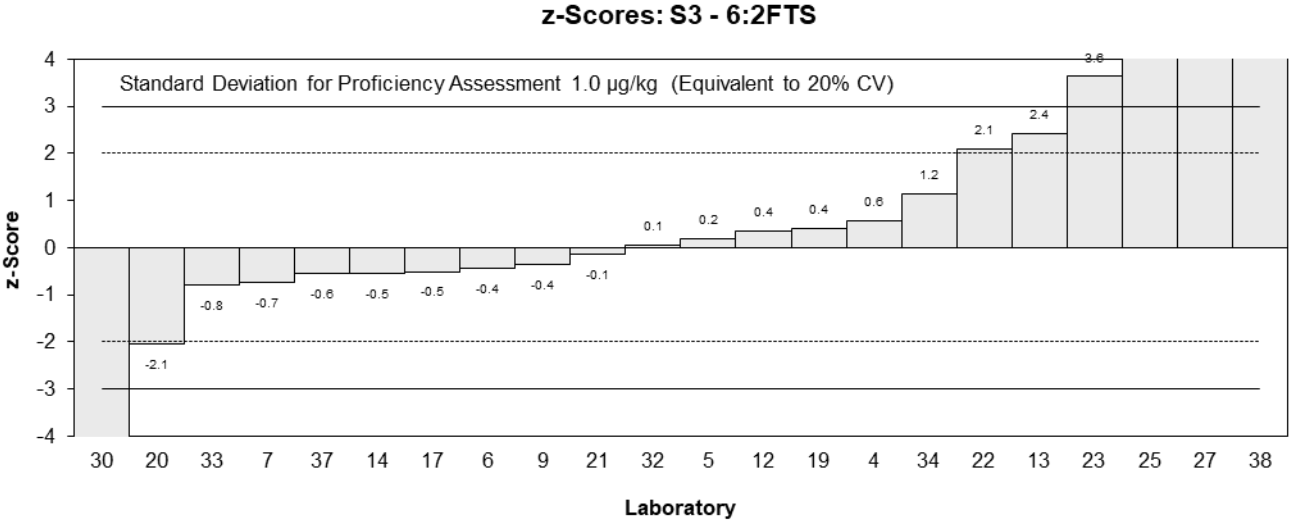
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 5.623 | 1.42 | 124 | 0.58 | 0.38 |
| **5** | 5.22405 | 1.567215 | 115 | 0.18 | 0.11 |
| **6** | 4.6 | 1.38 | 94 | -0.44 | -0.30 |
| **7** | 4.3 | 1.3 | NR | -0.73 | -0.53 |
| **8** | NS | NS | NS | | |
| **9** | 4.67 | 1.17 | 320 | -0.37 | -0.29 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 5.4 | 1.1 | 312 | 0.36 | 0.29 |
| **13** | 7.48 | 2.25 | 105 | 2.42 | 1.06 |
| **14** | 4.5 | 1.4 | 163 | -0.54 | -0.36 |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 4.530528 | 1.583394 | 143 | -0.51 | -0.31 |
| **18** | NT | NT | NT | | |
| **19** | 5.45 | 0.751 | 156 | 0.41 | 0.45 |
| **20** | 2.97 | 0.7 | 344 | -2.05 | -2.36 |
| **21** | 4.9 | NR | 78 | -0.14 | -0.26 |
| **22** | 7.15 | 2.15 | 94 | 2.09 | 0.95 |
| **23*** | 8.7 | 2.5 | 124 | 3.63 | 1.43 |
| **24** | NT | NT | NT | | |
| **25*** | 14 | NR | NR | 8.89 | 16.91 |
| **27*** | 15 | 6.7 | NT | 9.88 | 1.48 |
| **28** | < 20 | 10 | 124 | | |
| **29** | NS | NS | NS | | |
| **30*** | 0.98 | NR | NR | -4.03 | -7.66 |
| **31** | NS | NS | NS | | |
| **32** | 5.1 | 0.56 | NR | 0.06 | 0.08 |
| **33** | 4.24 | 1.27 | 118 | -0.79 | -0.58 |
| **34** | 6.2 | 2 | 114 | 1.15 | 0.56 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 4.49 | 1.347 | 116 | -0.55 | -0.38 |
| **38*** | 18 | 9 | NR | 12.86 | 1.44 |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 5.04 | 0.53 |
| **Spike Value** | 5.17 | 0.36 |
| **Robust Average** | 5.7 | 1.1 |
| **Median** | 5.16 | 0.61 |
| **Mean** | 6.5 | |
| **N** | 22 | |
| **Max** | 18 | |
| **Min** | 0.98 | |
| **Robust SD** | 2.1 | |
| **Robust CV** | 38% | |


Kernel Density
Density
Result
Results: S3 - 6:2FTS
Assigned Value = 5.04 ± 0.53 µg/kg
Results (µg/kg)
Laboratory
30 20 33 7 37 14 17 6 9 21 32 5 12 19 4 34 22 13 23 25 27 38 1 2 3 8 10 11 15 16 18 24 28 29 31 35 36 Md RA SV


z-Scores: S3 - 6:2FTS
Standard Deviation for Proficiency Assessment 1.0 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
30 20 33 7 37 14 17 6 9 21 32 5 12 19 4 34 22 13 23 25 27 38

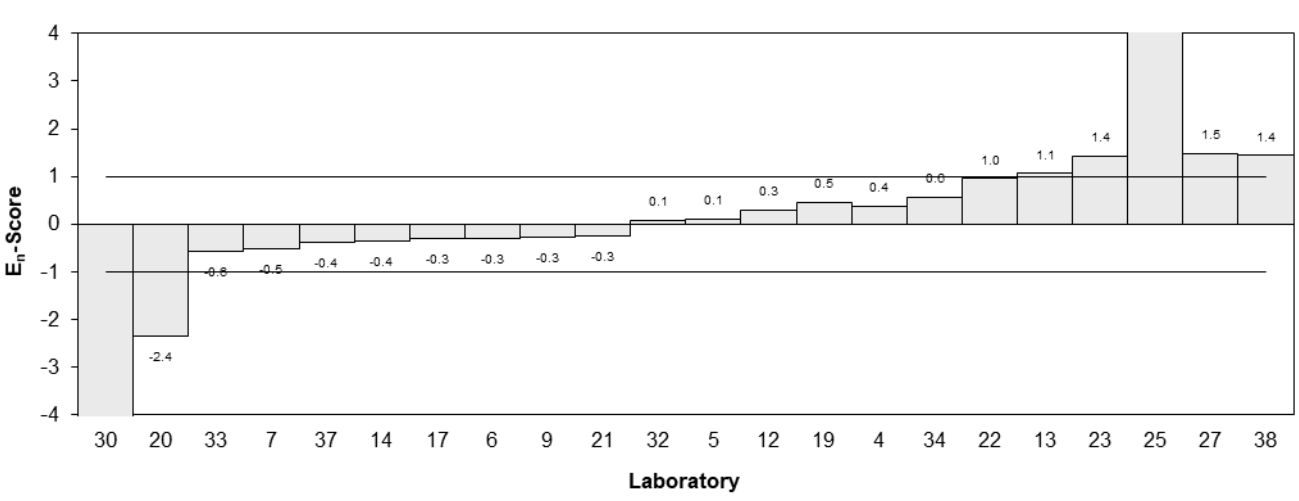

En-Scores: S3 - 6:2FTS
En-Score
Laboratory
30 20 33 7 37 14 17 6 9 21 32 5 12 19 4 34 22 13 23 25 27 38

Figure 73

Table 77

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | 6:2diPAP |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NS | NS | NS |
| **3** | NS | NS | NS |
| **4** | NT | NT | NT |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | NS | NS | NS |
| **9** | 25.0 | 6.3 | 134 |
| **10** | NS | NS | NS |
| **11** | NS | NS | NS |
| **12** | 19 | 3.8 | NR |
| **13** | NT | NT | NT |
| **14** | NT | NT | NT |
| **15** | NS | NS | NS |
| **16** | NS | NS | NS |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 22.6 | 2.37 | 124 |
| **20** | 15.8 | NR | 38 |
| **21** | 35 | NR | 102 |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 106 | 48 | NT |
| **28** | NT | NT | NT |
| **29** | NS | NS | NS |
| **30** | 4.72 | NR | NR |
| **31** | NS | NS | NS |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | NS | NS | NS |
| **36** | NS | NS | NS |
| **37** | NT | NT | NT |
| **38** | NT | NT | NT |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 24 | 15 |
| **Median** | 22.6 | 9.5 |
| **Mean** | 33 | |
| **N** | 7 | |
| **Max** | 106 | |
| **Min** | 4.72 | |
| **Robust SD** | 16 | |
| **Robust CV** | 65% | |

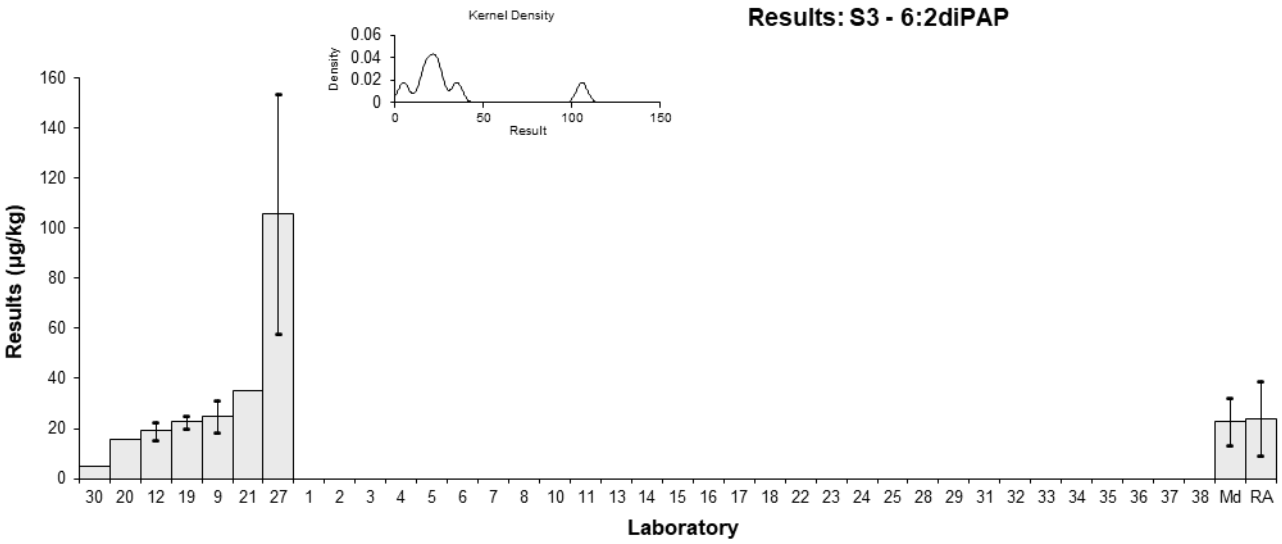

Results: S3 - 6:2diPAP
Kernel Density
Density
0.06
0.04
0.02
0
0
50
100
150
Result
Results (µg/kg)
160
140
120
100
80
60
40
20
0
30 20 12 19 9 21 27 1 2 3 4 5 6 7 8 10 11 13 14 15 16 17 18 22 23 24 25 28 29 31 32 33 34 35 36 37 38 Md RA
Laboratory

Figure 74

Table 78

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | 8:2diPAP |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | NT | NT | NT |
| **2** | NS | NS | NS |
| **3** | NS | NS | NS |
| **4** | NT | NT | NT |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | NT | NT | NT |
| **8** | NS | NS | NS |
| **9** | 21.9 | 5.5 | 220 |
| **10** | NS | NS | NS |
| **11** | NS | NS | NS |
| **12** | 20 | 4.0 | 227 |
| **13** | 32.24 | 7.42 | 52 |
| **14** | NT | NT | NT |
| **15** | NS | NS | NS |
| **16** | NS | NS | NS |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | NR | NR | NR |
| **20** | 17.3 | NR | 101 |
| **21** | 35 | NR | 489 |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 104 | 47 | NT |
| **28** | 7 | 3.5 | NR |
| **29** | NS | NS | NS |
| **30** | NR | NR | NR |
| **31** | NS | NS | NS |
| **32** | NT | NT | NT |
| **33** | NT | NT | NT |
| **34** | NT | NT | NT |
| **35** | NS | NS | NS |
| **36** | NS | NS | NS |
| **37** | NT | NT | NT |
| **38** | NT | NT | NT |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | 23.0 | 1.6 |
| **Robust Average** | 26 | 15 |
| **Median** | 22 | 14 |
| **Mean** | 34 | |
| **N** | 7 | |
| **Max** | 104 | |
| **Min** | 7 | |
| **Robust SD** | 16 | |
| **Robust CV** | 61% | |

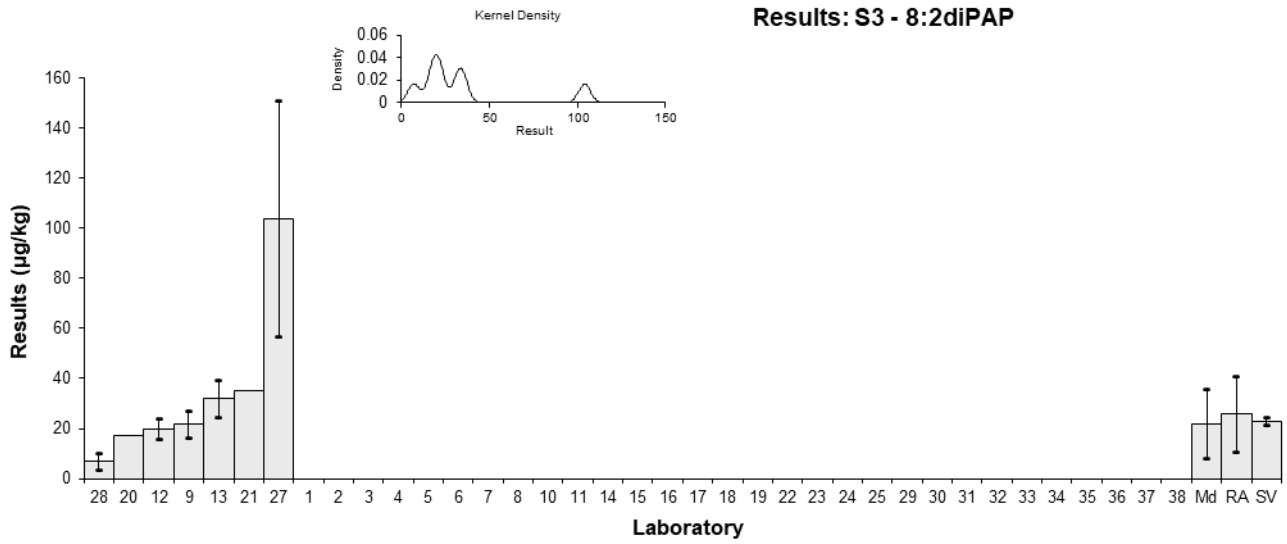

Results: S3 - 8:2diPAP
Kernel Density
Density
0.06
0.04
0.02
0
0
50
100
150
Result
Results (µg/kg)
160
140
120
100
80
60
40
20
0
28 20 12 9 13 21 27 1 2 3 4 5 6 7 8 10 11 14 15 16 17 18 19 22 23 24 25 29 30 31 32 33 34 35 36 37 38 Md RA SV
Laboratory

Figure 75

Table 79

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | 5:3FTCA |
| **Unit** | µg/kg |

**Participant Results**

| Lab. Code | Result | Uncertainty | Rec |
|---|---|---|---|
| **1** | 6.6 | 0.74 | 91 |
| **2** | NS | NS | NS |
| **3** | NS | NS | NS |
| **4** | NT | NT | NT |
| **5** | NT | NT | NT |
| **6** | NT | NT | NT |
| **7** | 0.84 | 0.25 | NR |
| **8** | NS | NS | NS |
| **9** | 6.13 | 1.53 | 105 |
| **10** | NS | NS | NS |
| **11** | NS | NS | NS |
| **12** | 11 | 2.2 | NR |
| **13** | <50 | NR | NR |
| **14** | NT | NT | NT |
| **15** | NS | NS | NS |
| **16** | NS | NS | NS |
| **17** | NT | NT | NT |
| **18** | NT | NT | NT |
| **19** | 11.9 | 2.86 | 96 |
| **20** | 5.2 | NR | 81 |
| **21** | 8 | NR | NR |
| **22** | NT | NT | NT |
| **23** | NT | NT | NT |
| **24** | NT | NT | NT |
| **25** | NT | NT | NT |
| **27** | 29 | 13 | NT |
| **28** | 11 | 5.5 | NR |
| **29** | NS | NS | NS |
| **30** | 0.78 | NR | NR |
| **31** | NS | NS | NS |
| **32** | 4.9 | 0.54 | NR |
| **33** | 1.44 | 0.432 | NR |
| **34** | 7.2 | 3 | 93 |
| **35** | NS | NS | NS |
| **36** | NS | NS | NS |
| **37** | NT | NT | NT |
| **38** | NT | NT | NT |

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | Not Set | |
| **Spike Value** | Not Spiked | |
| **Robust Average** | 6.9 | 3.4 |
| **Median** | 6.6 | 4.5 |
| **Mean** | 8.0 | |
| **N** | 13 | |
| **Max** | 29 | |
| **Min** | 0.78 | |
| **Robust SD** | 4.9 | |
| **Robust CV** | 72% | |

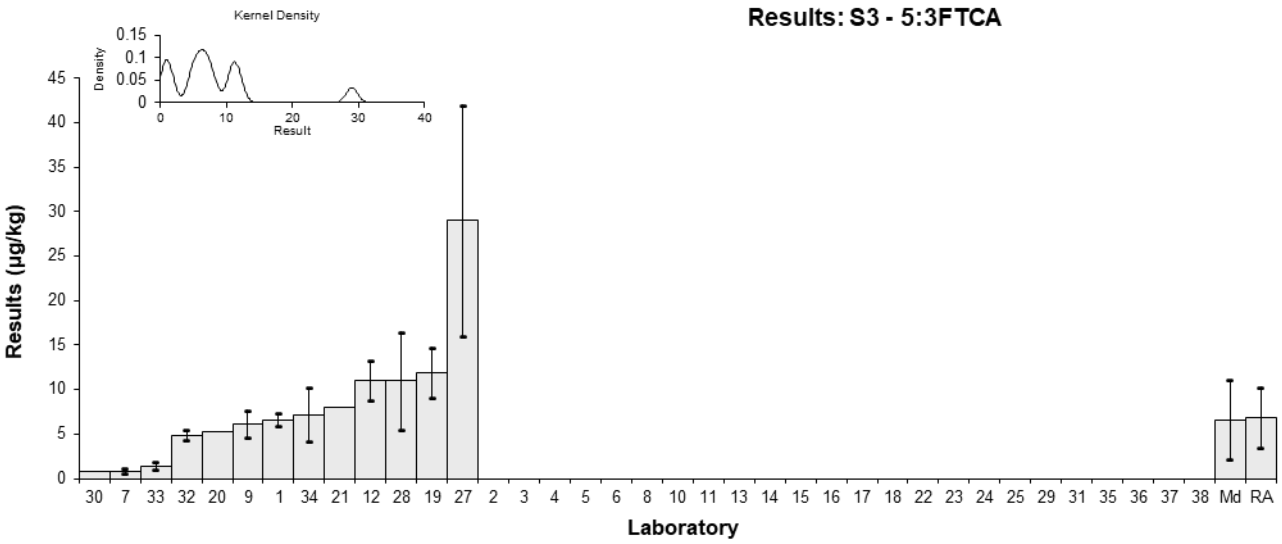

Results: S3 - 5:3FTCA
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
30 7 33 32 20 9 1 34 21 12 28 19 27 2 3 4 5 6 8 10 11 13 14 15 16 17 18 22 23 24 25 29 31 35 36 37 38 Md RA

Figure 76

Table 80

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | GenX |
| **Unit** | µg/kg |

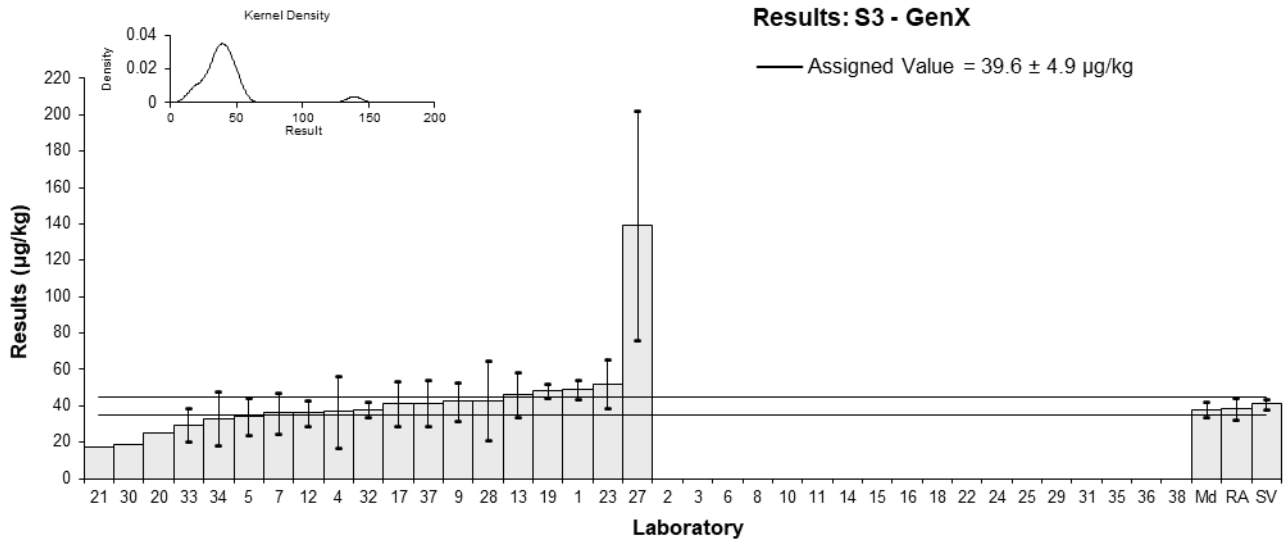
**Participant Results**

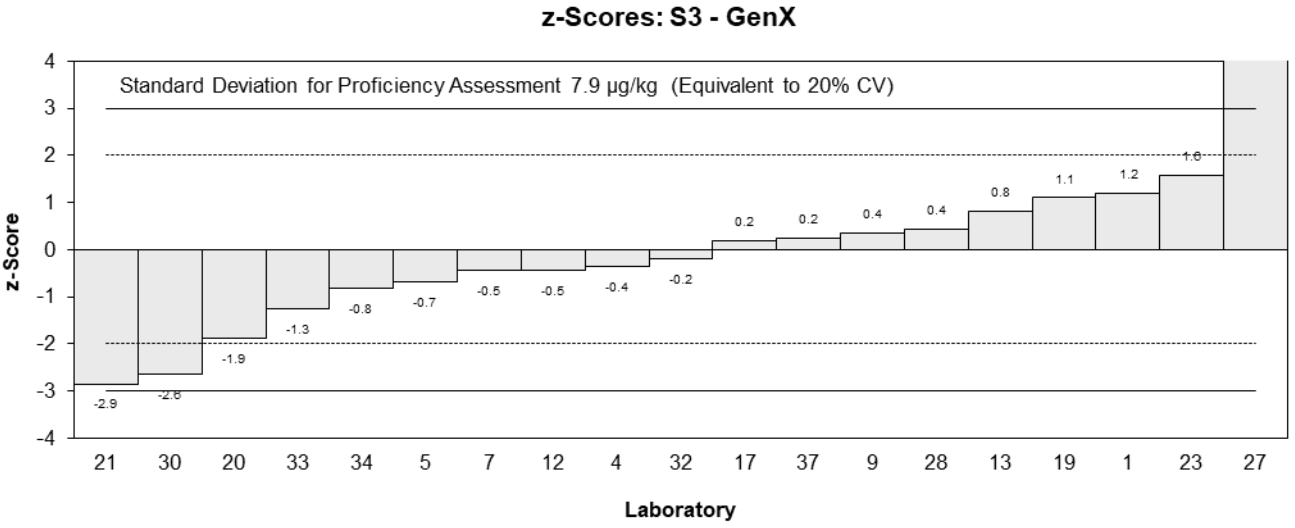
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 49 | 5.0 | 70 | 1.19 | 1.34 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 36.731 | 19.87 | 120 | -0.36 | -0.14 |
| **5** | 34.1807 | 10.25421 | 75 | -0.68 | -0.48 |
| **6** | NT | NT | NT | | |
| **7** | 36 | 11 | NR | -0.45 | -0.30 |
| **8** | NS | NS | NS | | |
| **9** | 42.4 | 10.6 | 91 | 0.35 | 0.24 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 36 | 7.2 | 60 | -0.45 | -0.41 |
| **13** | 45.99 | 12.42 | 61 | 0.81 | 0.48 |
| **14** | NT | NT | NT | | |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 41.10244 | 12.33073 | 51 | 0.19 | 0.11 |
| **18** | NT | NT | NT | | |
| **19** | 48.3 | 4.04 | 38 | 1.10 | 1.37 |
| **20** | 24.7 | NR | 102 | -1.88 | -3.04 |
| **21*** | 17 | NR | 59 | -2.85 | -4.61 |
| **22** | NT | NT | NT | | |
| **23** | 52.1 | 13.5 | 85 | 1.58 | 0.87 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 139 | 63 | NT | 12.55 | 1.57 |
| **28** | 43 | 22 | NR | 0.43 | 0.15 |
| **29** | NS | NS | NS | | |
| **30*** | 18.7 | NR | NR | -2.64 | -4.27 |
| **31** | NS | NS | NS | | |
| **32** | 38 | 4.0 | NR | -0.20 | -0.25 |
| **33** | 29.61 | 8.88 | 87 | -1.26 | -0.98 |
| **34** | 33 | 15 | 118 | -0.83 | -0.42 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 41.54 | 12.462 | 113 | 0.24 | 0.14 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 39.6 | 4.9 |
| **Spike Value** | 41.1 | 2.9 |
| **Robust Average** | 38.5 | 6.1 |
| **Median** | 38.0 | 4.3 |
| **Mean** | 42 | |
| **N** | 19 | |
| **Max** | 139 | |
| **Min** | 17 | |
| **Robust SD** | 11 | |
| **Robust CV** | 28% | |


Kernel Density
Density
Result
Results: S3 - GenX
Assigned Value = 39.6 ± 4.9 µg/kg
Results (µg/kg)
Laboratory
21 30 20 33 34 5 7 12 4 32 17 37 9 28 13 19 1 23 27 2 3 6 8 10 11 14 15 16 18 22 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - GenX
Standard Deviation for Proficiency Assessment 7.9 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
21 30 20 33 34 5 7 12 4 32 17 37 9 28 13 19 1 23 27

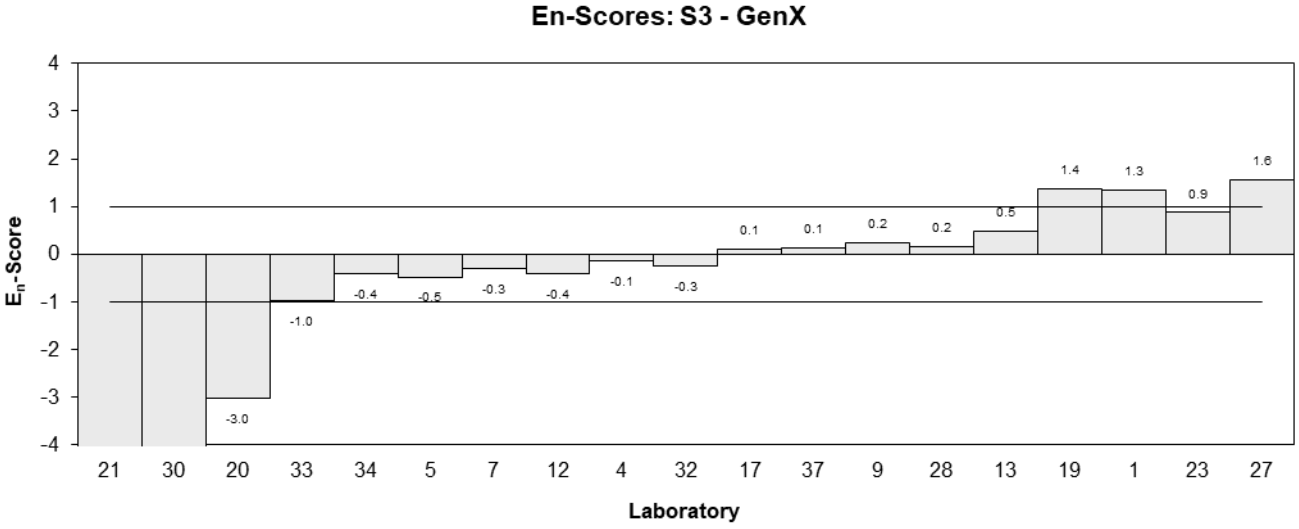

En-Scores: S3 - GenX
En-Score
Laboratory
21 30 20 33 34 5 7 12 4 32 17 37 9 28 13 19 1 23 27

Figure 77

Table 81

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | ADONA |
| **Unit** | µg/kg |

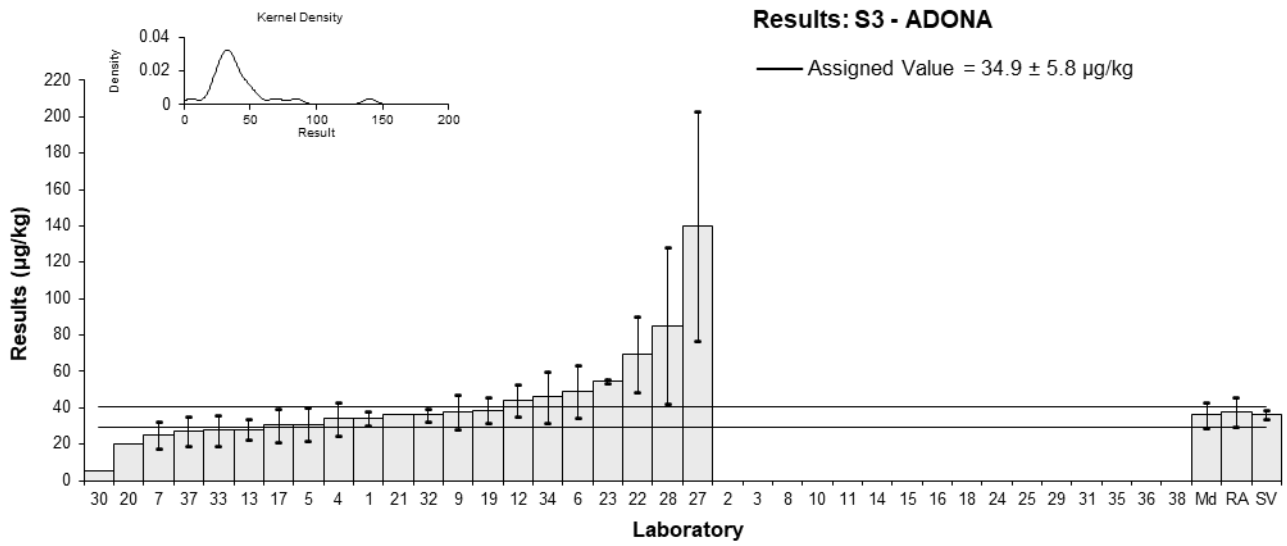
**Participant Results**

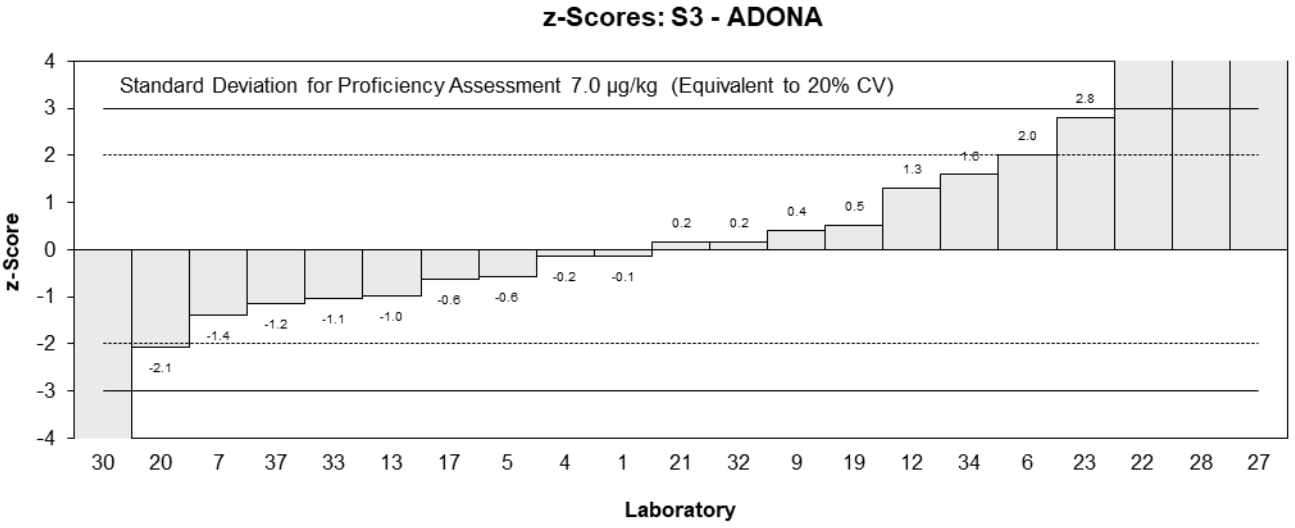
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | 34 | 3.8 | 91 | -0.13 | -0.13 |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 33.855 | 9.14 | NR | -0.15 | -0.10 |
| **5** | 30.92949 | 9.278847 | 95 | -0.57 | -0.36 |
| **6** | 49 | 14.7 | 106 | 2.02 | 0.89 |
| **7** | 25.14 | 7.5 | NR | -1.40 | -1.03 |
| **8** | NS | NS | NS | | |
| **9** | 37.7 | 9.4 | 98 | 0.40 | 0.25 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 44 | 8.8 | NR | 1.30 | 0.86 |
| **13** | 28.05 | 5.61 | NR | -0.98 | -0.85 |
| **14** | NT | NT | NT | | |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 30.44044 | 9.132132 | 51 | -0.64 | -0.41 |
| **18** | NT | NT | NT | | |
| **19** | 38.5 | 7.03 | 49 | 0.52 | 0.40 |
| **20** | 20.4 | NR | 87 | -2.08 | -2.50 |
| **21** | 36 | NR | NR | 0.16 | 0.19 |
| **22*** | 69.48 | 20.84 | 106 | 4.95 | 1.60 |
| **23** | 54.5 | 1.2 | NR | 2.81 | 3.31 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 140 | 63 | NT | 15.06 | 1.66 |
| **28*** | 85 | 43 | NR | 7.18 | 1.15 |
| **29** | NS | NS | NS | | |
| **30*** | 4.99 | NR | NR | -4.29 | -5.16 |
| **31** | NS | NS | NS | | |
| **32** | 36 | 3.8 | NR | 0.16 | 0.16 |
| **33** | 27.57 | 8.27 | NR | -1.05 | -0.73 |
| **34** | 46 | 14 | 67 | 1.59 | 0.73 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 26.87 | 8.061 | 104 | -1.15 | -0.81 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 34.9 | 5.8 |
| **Spike Value** | 36.1 | 2.5 |
| **Robust Average** | 37.8 | 8.0 |
| **Median** | 36.0 | 6.8 |
| **Mean** | 43 | |
| **N** | 21 | |
| **Max** | 140 | |
| **Min** | 4.99 | |
| **Robust SD** | 15 | |
| **Robust CV** | 39% | |


Kernel Density
Density
Result
Results: S3 - ADONA
Assigned Value = 34.9 ± 5.8 µg/kg
Results (µg/kg)
Laboratory
30 20 7 37 33 13 17 5 4 1 21 32 9 19 12 34 6 23 22 28 27 2 3 8 10 11 14 15 16 18 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - ADONA
Standard Deviation for Proficiency Assessment 7.0 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
30 20 7 37 33 13 17 5 4 1 21 32 9 19 12 34 6 23 22 28 27

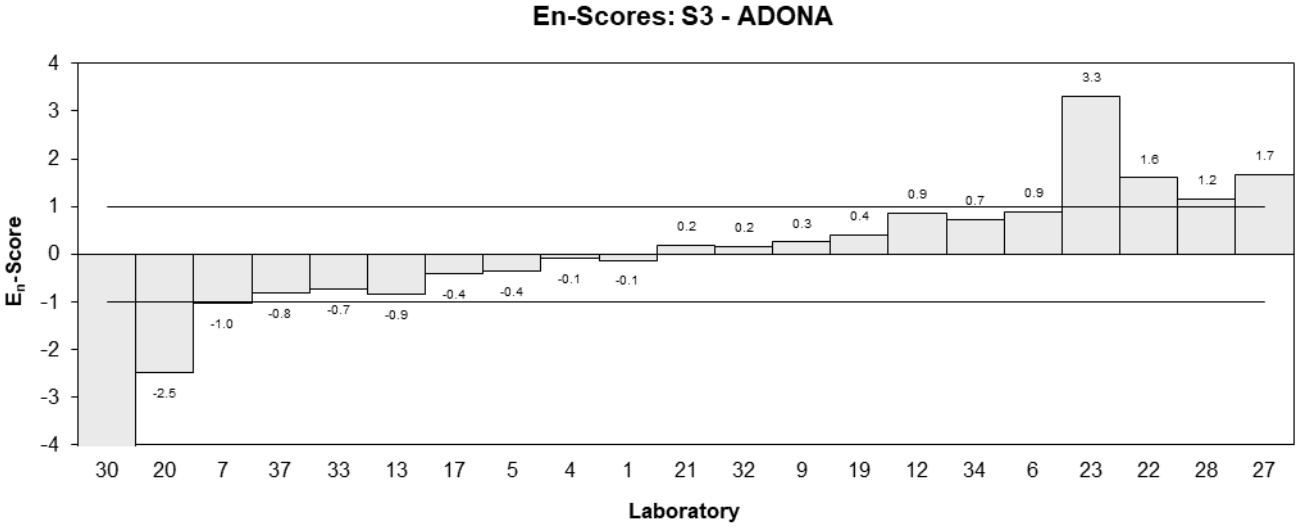

En-Scores: S3 - ADONA
En-Score
Laboratory
30 20 7 37 33 13 17 5 4 1 21 32 9 19 12 34 6 23 22 28 27

Figure 78

Table 82

**Sample Details**

| | |
|---|---|
| **Sample No.** | S3 |
| **Matrix** | Biosolids |
| **Analyte** | 11Cl-PF3OUdS |
| **Unit** | µg/kg |

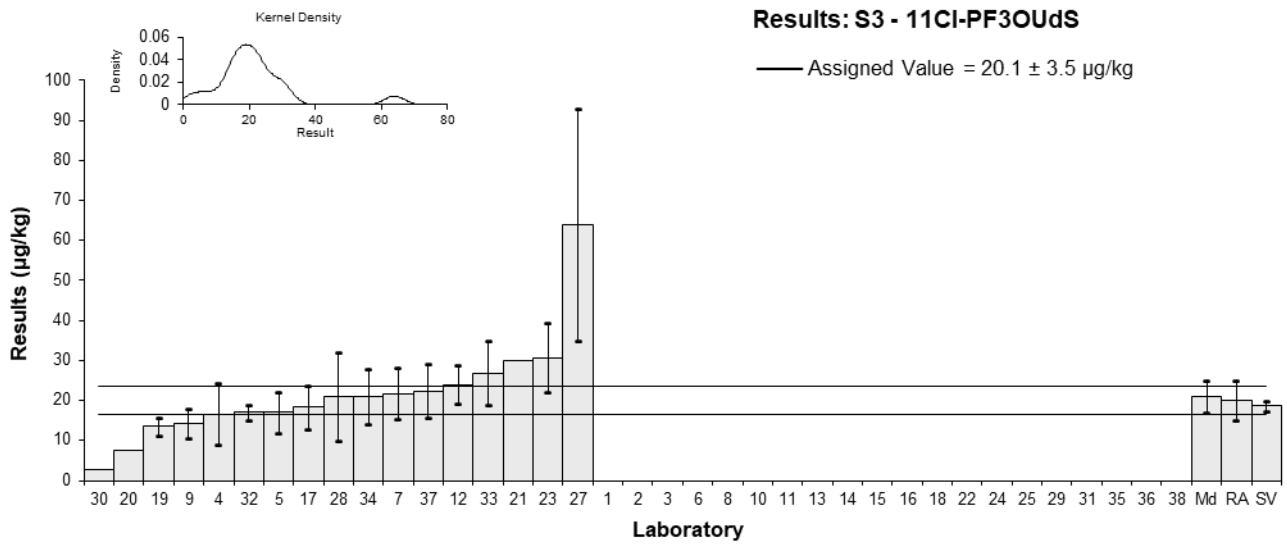
**Participant Results**

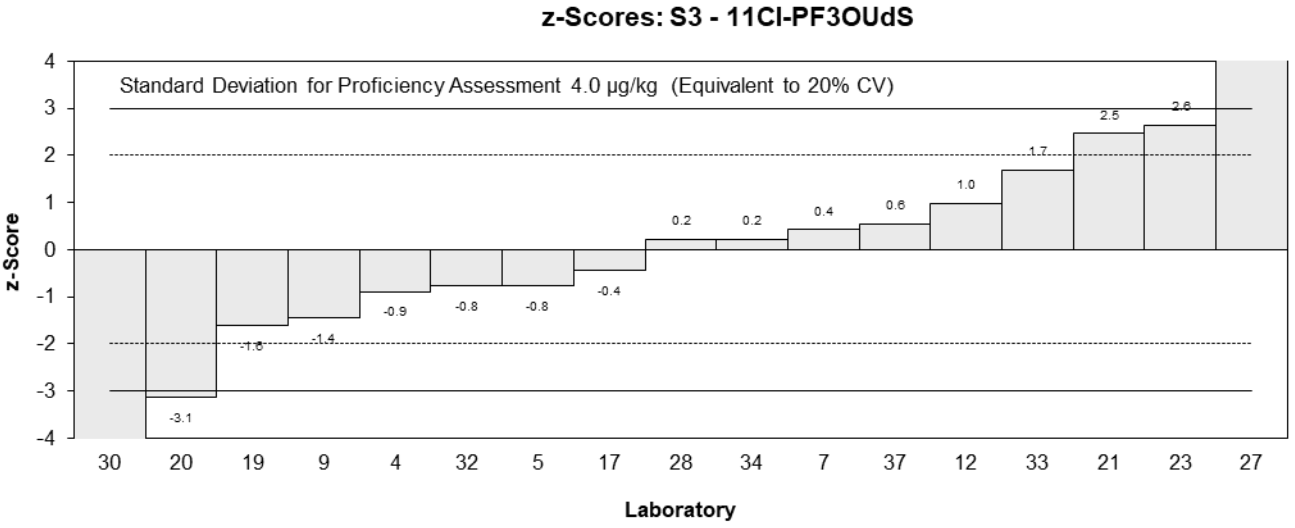
| Lab. Code | Result | Uncertainty | Rec | z | $E_n$ |
|---|---|---|---|---|---|
| **1** | NR | NR | NR | | |
| **2** | NS | NS | NS | | |
| **3** | NS | NS | NS | | |
| **4** | 16.53 | 7.68 | NR | -0.89 | -0.42 |
| **5** | 17.03269 | 5.109807 | 94 | -0.76 | -0.50 |
| **6** | NT | NT | NT | | |
| **7** | 21.77 | 6.5 | NR | 0.42 | 0.23 |
| **8** | NS | NS | NS | | |
| **9** | 14.3 | 3.6 | 98 | -1.44 | -1.16 |
| **10** | NS | NS | NS | | |
| **11** | NS | NS | NS | | |
| **12** | 24 | 4.8 | NR | 0.97 | 0.66 |
| **13** | <10 | NR | NR | | |
| **14** | NT | NT | NT | | |
| **15** | NS | NS | NS | | |
| **16** | NS | NS | NS | | |
| **17** | 18.33510 | 5.500532 | 84 | -0.44 | -0.27 |
| **18** | NT | NT | NT | | |
| **19** | 13.6 | 2.26 | 53 | -1.62 | -1.56 |
| **20*** | 7.5 | NR | 69 | -3.13 | -3.60 |
| **21** | 30 | NR | NR | 2.46 | 2.83 |
| **22** | NT | NT | NT | | |
| **23*** | 30.7 | 8.6 | NR | 2.64 | 1.14 |
| **24** | NT | NT | NT | | |
| **25** | NT | NT | NT | | |
| **27*** | 64 | 29 | NT | 10.92 | 1.50 |
| **28** | 21 | 11 | NR | 0.22 | 0.08 |
| **29** | NS | NS | NS | | |
| **30*** | 2.65 | NR | NR | -4.34 | -4.99 |
| **31** | NS | NS | NS | | |
| **32** | 17 | 1.8 | NR | -0.77 | -0.79 |
| **33** | 26.86 | 8.06 | NR | 1.68 | 0.77 |
| **34** | 21 | 7 | 97 | 0.22 | 0.11 |
| **35** | NS | NS | NS | | |
| **36** | NS | NS | NS | | |
| **37** | 22.32 | 6.696 | 104 | 0.55 | 0.29 |
| **38** | NT | NT | NT | | |

* Outlier, see Section 4.2

**Statistics**

| | | |
|---|---|---|
| **Assigned Value** | 20.1 | 3.5 |
| **Spike Value** | 18.7 | 1.3 |
| **Robust Average** | 20.1 | 5.0 |
| **Median** | 21.0 | 4.0 |
| **Mean** | 21.7 | |
| **N** | 17 | |
| **Max** | 64 | |
| **Min** | 2.65 | |
| **Robust SD** | 8.3 | |
| **Robust CV** | 41% | |


Results: S3 - 11Cl-PF3OUdS
Assigned Value = 20.1 ± 3.5 µg/kg
Kernel Density
Density
Result
Results (µg/kg)
Laboratory
30 20 19 9 4 32 5 17 28 34 7 37 12 33 21 23 27 1 2 3 6 8 10 11 13 14 15 16 18 22 24 25 29 31 35 36 38 Md RA SV


z-Scores: S3 - 11Cl-PF3OUdS
Standard Deviation for Proficiency Assessment 4.0 µg/kg (Equivalent to 20% CV)
z-Score
Laboratory
30 20 19 9 4 32 5 17 28 34 7 37 12 33 21 23 27

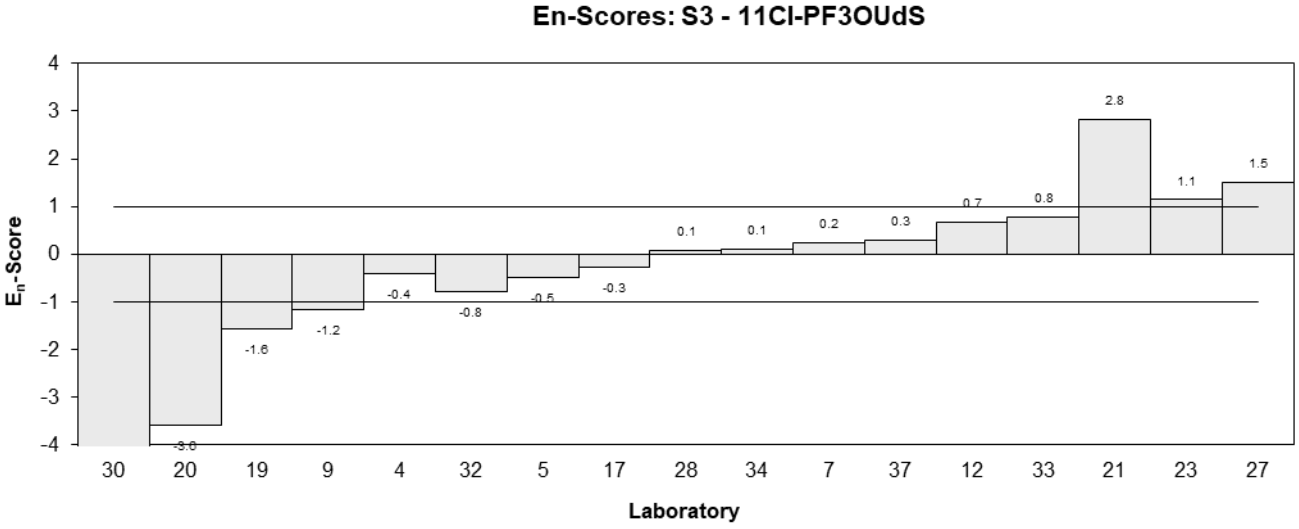

En-Scores: S3 - 11Cl-PF3OUdS
En-Score
Laboratory
30 20 19 9 4 32 5 17 28 34 7 37 12 33 21 23 27

Figure 79

## 6 DISCUSSION OF RESULTS

### 6.1 Assigned Value

Assigned values for all scored analytes were the robust averages of participants' results. If there were results less than 50% or greater than 150% of the robust average, these were excluded from the calculation of each assigned value.[3,4] The robust averages and associated expanded uncertainties were calculated using the procedures described in ISO 13528.[5] The calculation of the expanded uncertainty for the robust average is presented in Appendix 2, using Sample S2 PFOA as an example.

The results from Laboratory **25** in Sample S1 were consistently approximately eight times lower than the consensus value. Laboratory **36** reported results in units of mg/kg instead of µg/kg for Samples S1 and S2. To avoid unfair scoring, these results were excluded from the robust average calculations as they would bias the assigned value; they were also excluded from the calculation of all summary statistics. The results reported by Laboratories **27** and **38** for Sample S3 biosolids were biased high. The results reported by all these laboratories for their respective samples were not included in the analyses of extraction methods and of instrumental techniques employed by participants.

**Traceability**: The consensus of participants' results is not traceable to any external reference, so although expressed in SI units, metrological traceability has not been established.

No assigned values were set for PFDA, PFHpS, PFNS, PFDS, and PFDoS in S1, for PFODA, PFUdS, PFTrDS, 8:2diPAP, 6:2FTOH, 3:3FTCA, and 11Cl-PF3OUdS in S2 and for PFDoA, PFDoS, 6:2diPAP, 8:2diPAP, and 5:3FTCA in S3 because the results were too variable or too few.

A comparison of the assigned value versus spiked value for all fortified analytes in samples S2 and S3 are presented in Table 83. The soil and biosolid material used for preparation of Sample S2 and Sample S3 respectively may contain incurred analytes, which may explain some of the assigned values being higher than the spiked value. Incurred values (for some analytes) have been included in the spiked value for Sample S3 analytes (Table 83). The incurred value was determined by NMIA using a routine method.

Table 83 Comparison of Assigned Values and Spike Values

| Sample | Analyte | Assigned Value (µg/kg) | Spiked Value (µg/kg) | Assigned Value / Spiked Value (%) |
|---|---|---|---|---|
| S2 | PFBA | 2.00 | 1.96 | 102 |
| S2 | PFPeA | 2.41 | 2.44 | 99 |
| S2 | PFHpA | 1.70 | 1.62 | 105 |
| S2 | PFOA | 2.29 | 2.45 | 93 |
| S2 | PFNA | 1.93 | 1.86 | 104 |
| S2 | PFUdA | 4.40 | 4.41 | 100 |
| S2 | PFTeDA | 0.635 | 0.735 | 86 |
| S2 | PFHxDA | 6.2 | 9.80 | 63 |
| S2 | PFODA | 3.3* | 5.36 | 62 |
| S2 | PFBS | 1.91 | 1.95 | 98 |
| S2 | PFHxS | 1.60 | 1.72 | 93 |
| S2 | PFHxS_L | 1.33 | 1.39 | 96 |

| Sample | Analyte | Assigned Value (µg/kg) | Spiked Value (µg/kg) | Assigned Value / Spiked Value (%) |
|---|---|---|---|---|
| S2 | PFOS | 6.17 | 5.91 | 104 |
| S2 | PFOS_L | 4.82 | 4.66 | 103 |
| S2 | PFUdS | 16.3* | 19.6 | 83 |
| S2 | PFDoS | 9.6 | 14.8 | 65 |
| S2 | PFTrDS | 10.3* | 14.6 | 71 |
| S2 | PFOSA | 0.871 | 0.980 | 89 |
| S2 | EtFOSA | 3.16 | 3.43 | 92 |
| S2 | MeFOSAA | 4.34 | 4.90 | 89 |
| S2 | MeFOSE | 4.69 | 4.90 | 96 |
| S2 | 6:2FTS | 1.94 | 1.95 | 99 |
| S2 | 10:2FTS | 43.2 | 49.1 | 88 |
| S2 | 8:2diPAP | 2.05* | 4.90 | 42 |
| S2 | 3:3FTCA | 16.1* | 34.3 | 47 |
| S2 | GenX | 13.8 | 14.7 | 94 |
| S2 | PFMPA | 26.0 | 29.4 | 88 |
| S2 | 11Cl-PF3OUdS | 2.26* | 4.92 | 46 |
| S2 | PFEESA | 4.97 | 4.91 | 101 |
| S3 | PFBA | 11.1 | 11.1 | 100 |
| S3 | PFPeA | 5.92 | 5.11 | 116 |
| S3 | PFHxA | 4.39 | 4.78 | 92 |
| S3 | PFHpA | 3.69 | 3.14 | 118 |
| S3 | PFOA | 8.40 | 8.29 | 101 |
| S3 | PFNA | 5.92 | 5.15 | 115 |
| S3 | PFDA | 12.4 | 11.0 | 113 |
| S3 | PFTrDA | 8.9 | 13.6 | 65 |
| S3 | PFTeDA | 13.4 | 17.9 | 75 |
| S3 | PFBS | 6.58 | 6.22 | 106 |
| S3 | PFHxS | 2.92 | 2.98 | 98 |
| S3 | PFHxS_L | 2.84 | 2.55 | 111 |
| S3 | PFHpS | 11.1 | 10.3 | 108 |
| S3 | PFOS | 11.4 | 11.5 | 99 |
| S3 | PFOS_L | 9.2 | 9.05 | 102 |
| S3 | PFNS | 1.09 | 1.18 | 92 |
| S3 | PFDS | 25.5 | 30.7 | 83 |
| S3 | PFDoS | 20.8* | 30.9 | 67 |
| S3 | PFOSA | 5.10 | 5.15 | 99 |
| S3 | EtFOSAA | 18.1 | 20.5 | 88 |

| Sample | Analyte | Assigned Value (µg/kg) | Spiked Value (µg/kg) | Assigned Value / Spiked Value (%) |
|---|---|---|---|---|
| S3 | 6:2FTS | 5.04 | 5.17 | 97 |
| S3 | 8:2diPAP | 26* | 23.0 | 113 |
| S3 | GenX | 39.6 | 41.1 | 96 |
| S3 | ADONA | 34.9 | 36.1 | 97 |
| S3 | 11Cl-PF3OUdS | 20.1 | 18.7 | 107 |

*Robust Average or Median Value as applicable (assigned value not set).

### 6.2 Measurement Uncertainty Reported by Participants

Participants were asked to report the expanded MU associated with their results and the basis of measurement uncertainty evaluation. It is a requirement of ISO/IEC 17025 that laboratories have procedures to evaluate the uncertainty of chemical measurements and to report this uncertainty in specific circumstances, including when the customer's instruction so requires.[7]

Laboratory **11** reported relative uncertainties ($x$%). Where numeric results were reported, these have been converted to absolute uncertainties, in µg/kg, by the study coordinator.

Of 1621 numerical results, 1502 (93%) were reported with measurement uncertainty. Laboratories **20**, **21**, **23**, **27**, **31**, and **37** reported numeric results without uncertainties for some analytes but were accredited to ISO/IEC 17025. Laboratory **25** stated being accredited to a different standard but did not report uncertainties for any numeric results. Laboratory **30** did not report any uncertainties and did not state their accreditation status. Laboratory **32** did not report their accreditation status either, but they did report uncertainties for all their results except one. Laboratories **3**, **4**, **11**, **19**, and **38** reported uncertainties for all numeric results and were not accredited. Laboratories **7** and **12** also provided uncertainties for all numeric results but did not specify whether they are accredited.

The participants used a wide variety of procedures to evaluate expanded measurement uncertainty. These are presented in Tables 3 and 4. Participation in proficiency testing programs allows participants to check how reasonable their evaluations of uncertainty are. Results and the expanded MU are presented in the bar charts for each analyte in this study (Figures 2 to 79). The magnitude of the reported expanded uncertainties was within the range 1% to 733% of the reported value.

Laboratories **2**, **4**, **19**, **20**, **23**, **31**, **32**, and **36** should review their procedure for evaluating measurement uncertainty as some of the reported relative uncertainties were lower than 10%, which the study coordinator believes is unrealistically small for routine PFAS measurements. Results that returned an acceptable $z$-score but an unacceptable $E_n$-score may have an underestimated uncertainty.

Laboratories **2**, **4**, **19**, **22**, **28**, **32**, **34**, and **35** who reported relative uncertainties greater than 50% should also review their procedure as it might not be fit-for-purpose.

Laboratories **4**, **27**, **28**, and **36** attached an evaluation of the expanded measurement uncertainty to a result reported as being less than their limit of reporting. An evaluation of uncertainty expressed as a numerical value cannot be attached to a result expressed as a range.[8]

Laboratories **5**, **8**, and **17** reported some results, uncertainties, and/or recoveries with a large number of significant figures. Although all significant figures were used for results assessment ($z$-score and $E_n$-score calculation), the last digits were omitted from the tables in Section 5 due to lack of space.

In some cases, results were reported with an inappropriate number of significant figures. Including too many significant figures may inaccurately reflect the precision of measurements. The recommended format is to write uncertainty to no more than two significant figures and then to write the result with the corresponding number of decimal places (for example a result of '1.86226 ± 0.18622 µg/kg', should instead be expressed as '1.86 ± 0.19 µg/kg').[8]

### 6.3 *z*-Score

The *z*-score compares the participant's deviation from the assigned value based on the standard deviation for proficiency assessment (SDPA).

The SDPA defines acceptable performance in a proficiency test. SDPAs equivalent to 20% performance coefficient of variation (PCV) were used to calculate z-scores in this study. Unlike the standard deviation based on between-laboratory CV, setting the SDPA as a realistic value enables z-scores to be used as fixed reference value points for assessment of individual laboratory performance, independent of the group's performance.

The between-laboratory coefficient of variation predicted by the Thompson-Horwitz equation[6] and the between-laboratory coefficient of variation from reported results in this study are presented for comparison in Table 84.

Table 84 Standard Deviation for Proficiency Assessment, Thompson-Horwitz and Between-Laboratory CV

| Sample | Analyte | Numeric Results Reported* | Assigned Value (µg/kg) | Between-Laboratory CV* (%) | Thompson-Horwitz CV* (%) | SDPA (as PCV, %) |
|---|---|---|---|---|---|---|
| S1 | PFBA | 26 | 26.8 | 8.5 | 22 | 20 |
| S1 | PFPeA | 27 | 56.2 | 11 | 22 | 20 |
| S1 | PFHxA | 27 | 246 | 12 | 20 | 20 |
| S1 | PFHpA | 27 | 21.2 | 15 | 22 | 20 |
| S1 | PFOA | 27 | 91.4 | 18 | 22 | 20 |
| S1 | PFNA | 7 | 0.77 | 24 | 22 | 20 |
| S1 | PFDA | 5 | 0.224** | 9.1 | 22 | Not Set |
| S1 | PFDoA | 12 | 0.392 | 24 | 22 | 20 |
| S1 | PFBS | 28 | 51.9 | 11 | 22 | 20 |
| S1 | PFPeS | 26 | 86.1 | 18 | 22 | 20 |
| S1 | PFHxS | 27 | 874 | 13 | 16 | 20 |
| S1 | PFHxS_L | 15 | 790 | 10 | 17 | 20 |
| S1 | PFHpS | 27 | 168** | 36 | 21 | Not Set |
| S1 | PFOS | 26 | 11200 | 18 | 11 | 20 |
| S1 | PFOS_L | 18 | 8020 | 18 | 12 | 20 |
| S1 | PFNS | 24 | 46** | 74 | 22 | Not Set |
| S1 | PFDS | 24 | 12.3** | 79 | 22 | Not Set |
| S1 | PFDoS | 10 | 9.1** | 84 | 22 | Not Set |
| S1 | PFOSA | 27 | 52.5 | 22 | 22 | 20 |

| Sample | Analyte | Numeric Results Reported* | Assigned Value (µg/kg) | Between-Laboratory CV* (%) | Thompson-Horwitz CV* (%) | SDPA (as PCV, %) |
|---|---|---|---|---|---|---|
| S1 | MeFOSAA | 7 | 0.68 | 24 | 22 | 20 |
| S2 | PFBA | 29 | 2.00 | 8.9 | 22 | 20 |
| S2 | PFPeA | 30 | 2.41 | 15 | 22 | 20 |
| S2 | PFHpA | 29 | 1.70 | 13 | 22 | 20 |
| S2 | PFOA | 32 | 2.29 | 11 | 22 | 20 |
| S2 | PFNA | 30 | 1.93 | 10 | 22 | 20 |
| S2 | PFUdA | 28 | 4.40 | 11 | 22 | 20 |
| S2 | PFTeDA | 17 | 0.635 | 14 | 22 | 20 |
| S2 | PFHxDA | 12 | 6.2 | 22 | 22 | 20 |
| S2 | PFODA | 6 | 3.3** | 48 | 22 | Not Set |
| S2 | PFBS | 30 | 1.91 | 9.7 | 22 | 20 |
| S2 | PFHxS | 30 | 1.60 | 12 | 22 | 20 |
| S2 | PFHxS_L | 20 | 1.33 | 9.6 | 22 | 20 |
| S2 | PFOS | 32 | 6.17 | 12 | 22 | 20 |
| S2 | PFOS_L | 22 | 4.82 | 14 | 22 | 20 |
| S2 | PFUdS | 5 | 16.3** | 2.7 | 22 | Not Set |
| S2 | PFDoS | 13 | 9.6 | 27 | 22 | 20 |
| S2 | PFTrDS | 5 | 10.3** | 29 | 22 | Not Set |
| S2 | PFOSA | 23 | 0.871 | 13 | 22 | 20 |
| S2 | EtFOSA | 26 | 3.16 | 12 | 22 | 20 |
| S2 | MeFOSAA | 27 | 4.34 | 23 | 22 | 20 |
| S2 | MeFOSE | 22 | 4.69 | 15 | 22 | 20 |
| S2 | 6:2FTS | 26 | 1.94 | 12 | 22 | 20 |
| S2 | 10:2FTS | 25 | 43.2 | 17 | 22 | 20 |
| S2 | 8:2diPAP | 12 | 2.05** | 35 | 22 | Not Set |
| S2 | 3:3FTCA | 14 | 16.1** | 28 | 22 | Not Set |
| S2 | GenX | 23 | 13.8 | 16 | 22 | 20 |
| S2 | PFMPA | 12 | 26.0 | 23 | 22 | 20 |
| S2 | 11Cl-PF3OUdS | 20 | 2.26** | 20 | 22 | Not Set |
| S2 | PFEESA | 12 | 4.97 | 15 | 22 | 20 |
| S3 | PFBA | 16 | 11.1 | 19 | 22 | 20 |
| S3 | PFPeA | 20 | 5.92 | 27 | 22 | 20 |
| S3 | PFHxA | 21 | 4.39 | 16 | 22 | 20 |
| S3 | PFHpA | 19 | 3.69 | 12 | 22 | 20 |
| S3 | PFOA | 20 | 8.40 | 13 | 22 | 20 |

| Sample | Analyte | Numeric Results Reported* | Assigned Value (µg/kg) | Between-Laboratory CV* (%) | Thompson-Horwitz CV* (%) | SDPA (as PCV, %) |
|---|---|---|---|---|---|---|
| S3 | PFNA | 20 | 5.92 | 15 | 22 | 20 |
| S3 | PFDA | 19 | 12.4 | 18 | 22 | 20 |
| S3 | PFDoA | 9 | 0.80** | 42 | 22 | Not Set |
| S3 | PFTrDA | 15 | 8.9 | 27 | 22 | 20 |
| S3 | PFTeDA | 15 | 13.4 | 33 | 22 | 20 |
| S3 | PFBS | 18 | 6.58 | 16 | 22 | 20 |
| S3 | PFHxS | 17 | 2.92 | 8.5 | 22 | 20 |
| S3 | PFHxS_L | 11 | 2.84 | 9.9 | 22 | 20 |
| S3 | PFHpS | 20 | 11.1 | 17 | 22 | 20 |
| S3 | PFOS | 19 | 11.4 | 22 | 22 | 20 |
| S3 | PFOS_L | 14 | 9.2 | 24 | 22 | 20 |
| S3 | PFNS | 11 | 1.09 | 29 | 22 | 20 |
| S3 | PFDS | 14 | 25.5 | 26 | 22 | 20 |
| S3 | PFDoS | 12 | 20.8** | 53 | 22 | Not Set |
| S3 | PFOSA | 19 | 5.10 | 19 | 22 | 20 |
| S3 | EtFOSAA | 18 | 18.1 | 28 | 22 | 20 |
| S3 | 6:2FTS | 17 | 5.04 | 17 | 22 | 20 |
| S3 | 6:2diPAP | 7 | 24** | 65 | 22 | Not Set |
| S3 | 8:2diPAP | 7 | 26** | 61 | 22 | Not Set |
| S3 | 5:3FTCA | 13 | 6.9** | 72 | 22 | Not Set |
| S3 | GenX | 16 | 39.6 | 20 | 22 | 20 |
| S3 | ADONA | 17 | 34.9 | 27 | 22 | 20 |
| S3 | 11Cl-PF3OUdS | 13 | 20.1 | 25 | 22 | 20 |

*Values exclude outliers if applicable. Shaded cells represent between-laboratory CVs higher than both the SDPA and the Thompson-Horwitz CV for scored analytes. Thompson-Horwitz CV calculated from the assigned value. **Robust Average or Median Value as applicable (assigned value not set).

To account for possible bias in the consensus values due to laboratories using inefficient analytical or extraction techniques, z-scores were adjusted for PFHxDA and PFDoS in Sample S2, and PFTrDA and PFTeDA in Sample S3. Where the assigned value is less than 80% of the spiked value, a maximum acceptable result was set as the spiked value plus two SDPAs of the spiked value. Results lower than the maximum acceptable result but with a *z*-score greater than 2.0 had their *z*-score adjusted to 2.0. This ensured that any participants reporting results close to the spiked value were not penalised. *z*-Scores for results greater than the maximum acceptable result, and *z*-scores less than 2.0, were left unaltered.

The dispersal of participants' *z*-scores is graphically presented by laboratory in Figures 80 and 81 and by analyte in Figures 82 and 83. Of the 1411 results for which z-scores were calculated, 1232 (87%) returned an acceptable z-score of $|z| \leq 2.0$ and 63 (4%) were questionable with a *z*-score of $2.0 < |z| < 3.0$. Participants with multiple *z*-scores larger than 2.0 or smaller than -2.0 should check for method or laboratory bias.

### 6.4 $E_n$-Score

$E_n$-score can be interpreted in conjunction with z-scores. The $E_n$-score indicates how closely a result agrees with the assigned value taking into account the respective uncertainties. An unacceptable $E_n$ score for an analyte can either be caused by an inappropriate measurement, an inappropriate evaluation of measurement uncertainty, or both. For results whose *z*-scores were adjusted as discussed in Section 6.3, no $E_n$-score has been calculated.

The dispersal of participants' $E_n$-scores is graphically presented in Figure 84. Where a laboratory did not report an expanded uncertainty with a result, an expanded uncertainty of zero (0) was used to calculate the $E_n$-score.

Of 1405 results for which $E_n$-scores were calculated, 1110 (79%) returned an acceptable score of $|E_n| < 1.0$ indicating agreement of the participants' results with the assigned values within their respective expanded measurement uncertainties.

### 6.5 Summary of Participants' Results and Performances

Summaries of participants' results and performance for scored analytes in this PT study are presented in Tables 85 to 87 and Figures 80 to 85.

Twenty-six laboratories reported at least one PFAS analyte that was not spiked into the test samples. These results are presented in Appendix 4.

Of 37 participants, 35 reported results for at least one of the two soil samples and 26 reported results for the biosolids sample S3.

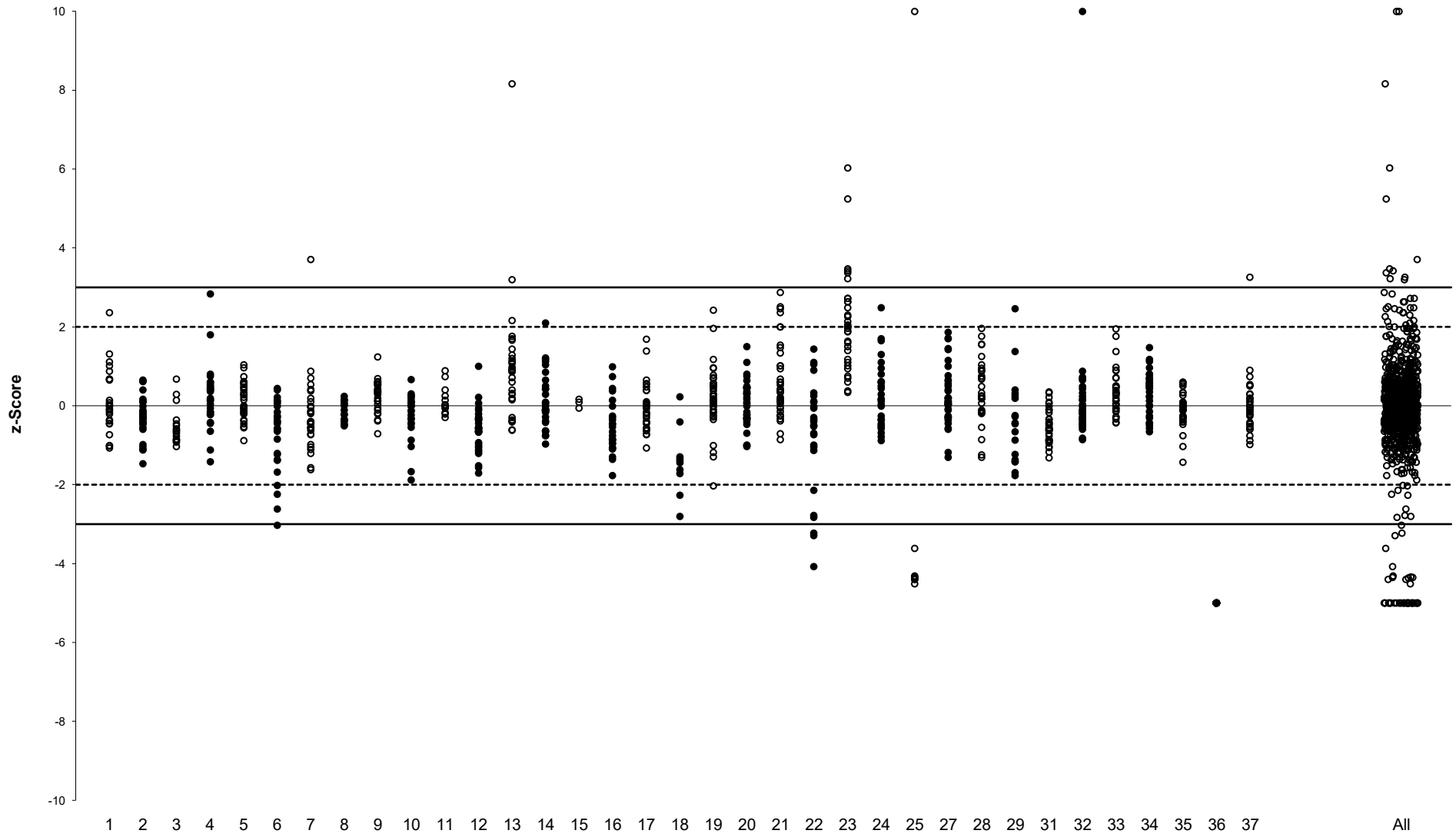
Laboratory **27** reported results for all the analytes for which z-scores were calculated (61).

Laboratory **19** returned the highest number of acceptable z-scores with 56 out of 58 reported.

All results reported by Laboratories **12** (53), **5** (49), **9** (47), **31** (35), **35** (35), **2** (33), **16** (25), **10** (24), **8** (17), **3** (16), **11** (13), and **15** (3) returned acceptable z-scores (Figure 85).

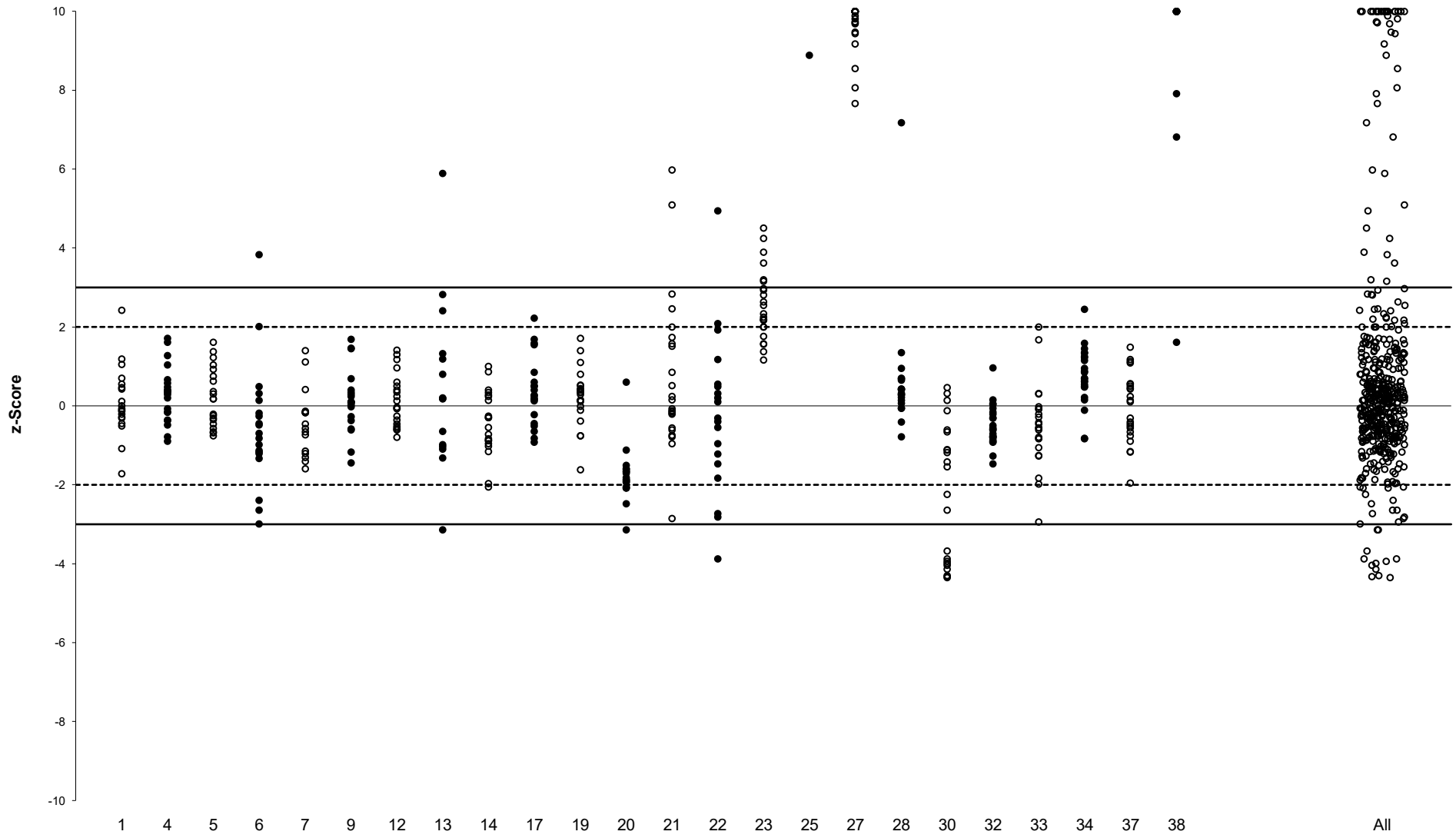
Laboratory **34** returned the highest number of acceptable $E_n$-scores for all their 54 reported results. Laboratories **3**, **5**, **8**, **11**, **15**, **17**, and **35** returned acceptable $E_n$-scores for all scored analytes.

The results reported by Laboratory **25** for Sample S1, by Laboratory **36** for Samples S1 and S2, and by Laboratories **27** and **38** for Sample S3 were not included in the analysis of extraction methods and instrumental techniques employed (see Section 6.1).



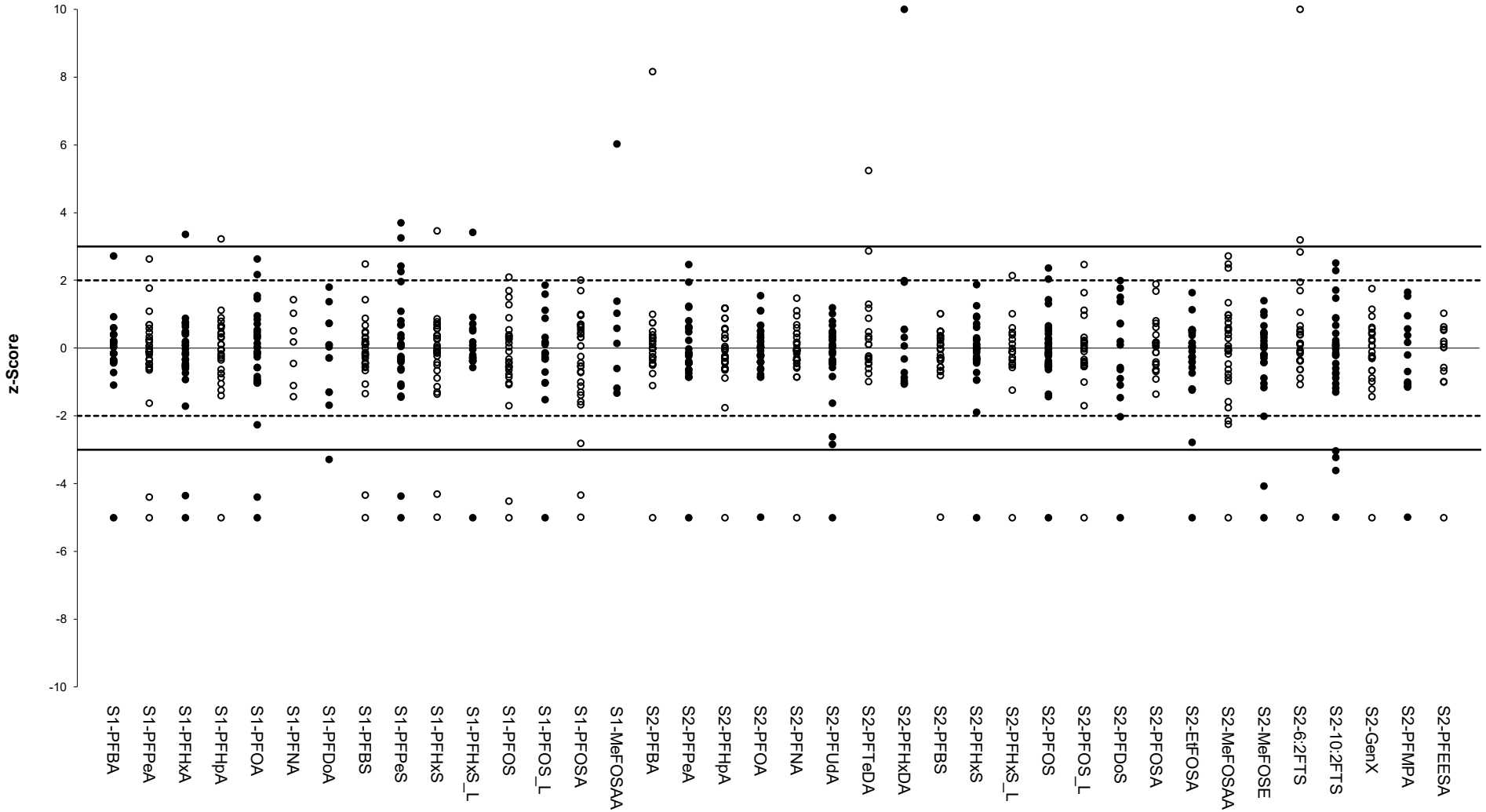

Scores greater than 10.0 have been plotted as 10.0

Figure 80 z-Score Dispersal by Laboratory for Samples S1 and S2



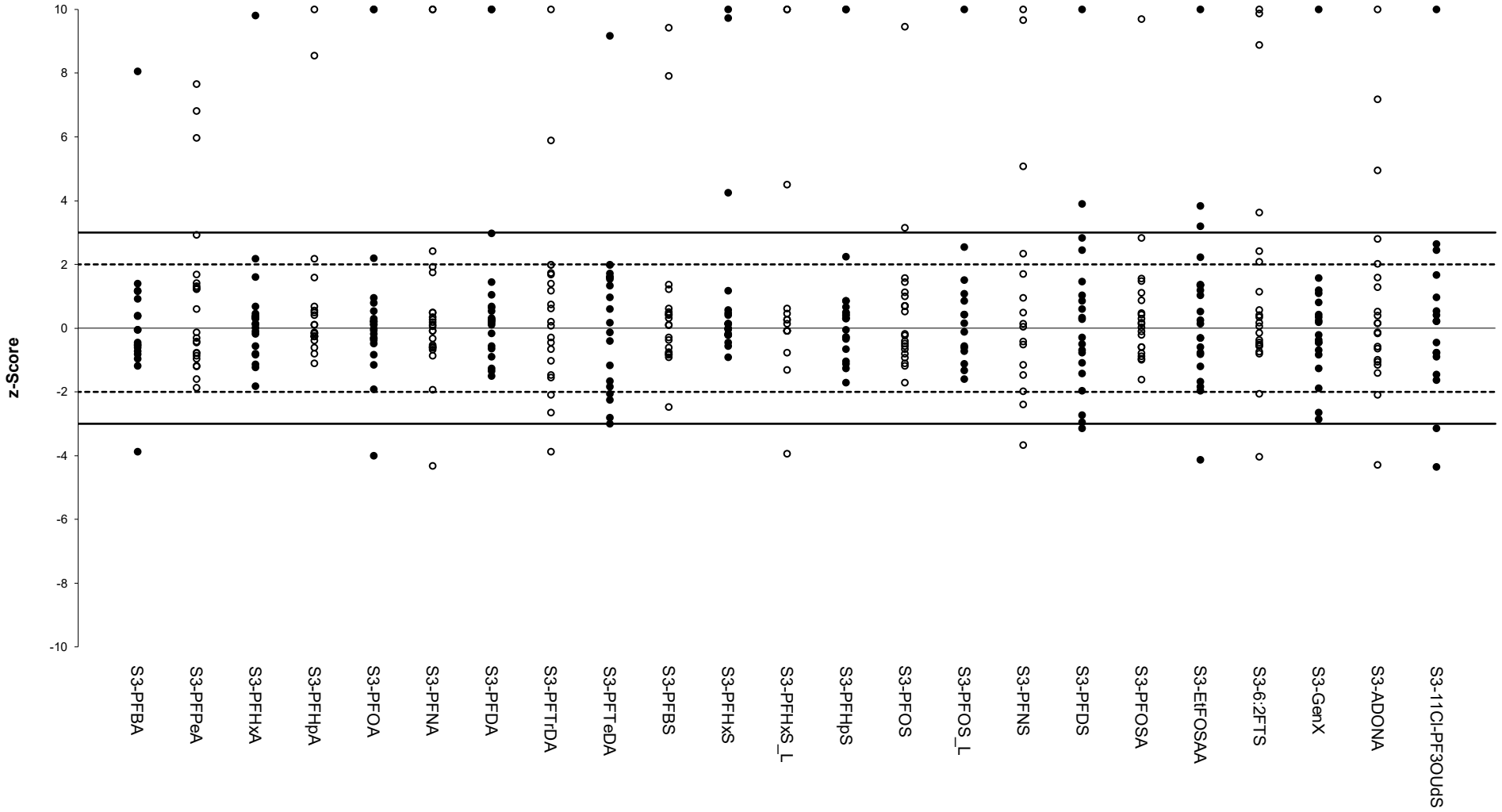

Scores greater than 10.0 have been plotted as 10.0

Figure 81 z-Score Dispersal by Laboratory for Sample S3



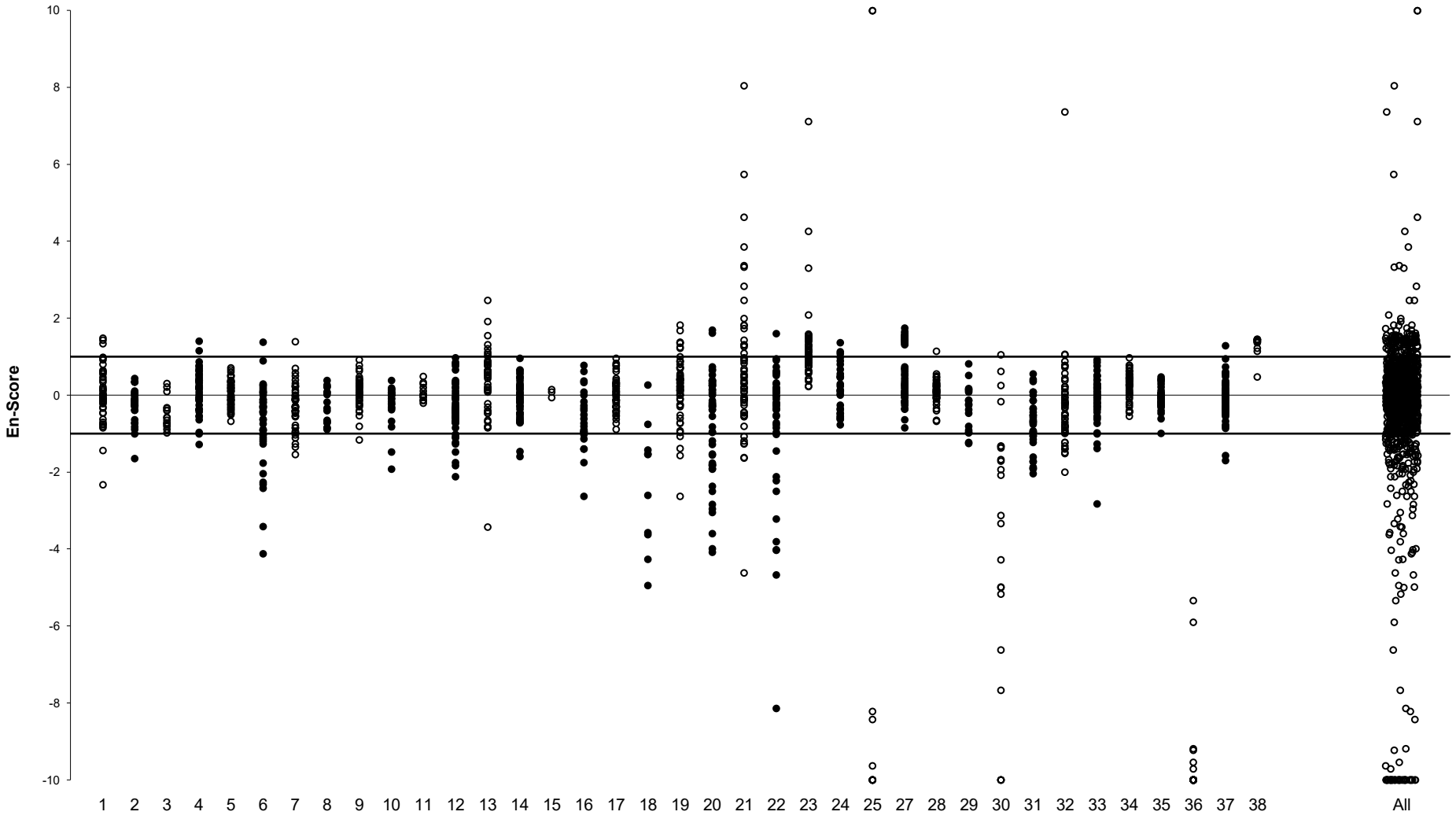

Scores greater than 10.0 have been plotted as 10.0

Figure 82 z-Score Dispersal by Analyte for Samples S1 and S2




Scores greater than 10.0 have been plotted as 10.0

Figure 83 z-Score Dispersal by Analyte for Sample S3




Scores greater than 10.0 or less than -10.0 have been plotted as 10.0 or -10.0 respectively.

Figure 84 $E_n$-Score Dispersal by Laboratory

Table 85 Summary of Participants' Results and Performance for Sample S1*

| Lab. Code | PFBA (µg/kg) | PFPeA (µg/kg) | PFHxA (µg/kg) | PFHpA (µg/kg) | PFOA (µg/kg) | PFNA (µg/kg) | PFDA (µg/kg) | PFDoA (µg/kg) | PFBS (µg/kg) | PFPeS (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| AV | 26.8 | 56.2 | 246 | 21.2 | 91.4 | 0.77 | Not Set | 0.392 | 51.9 | 86.1 |
| 1 | 26 | 51 | 250 | 24 | 92 | <5.0 | <1.0 | <1.0 | 59 | 80 |
| 2 | 26 | 52.6 | 277 | 21.7 | 89.4 | 0.6 | 0.4 | 0.4 | 47.3 | 88.2 |
| 3 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 4 | 27.676 | 55.539 | 255.716 | 20.257 | 101.335 | <0.3 | <0.2 | 0.533 | 47.527 | 61.837 |
| 5 | 29.01177 | 62.88725 | 237.3048 | 21.05883 | 88.56493 | <1 | 0.22867 | 0.44974 | 56.52074 | 79.93156 |
| 6 | 28 | 57 | 238 | 16 | 76 | <0.001 | <0.001 | 0.26 | 53 | 93 |
| 7 | 26 | 50 | 210 | 23 | 89 | <5 | <5 | <5 | 61 | 150 |
| 8 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 9 | 24.9 | 64 | 267 | 23.8 | 98.3 | <2 | <2 | <2 | 55.3 | 88.3 |
| 10 | 24.5 | 51 | 230 | 17.5 | 72.5 | <1 | <1 | <1 | 49.5 | 91.5 |
| 11 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 12 | 28 | 49 | 200 | 21 | 73 | NR | NR | NR | 41 | 67 |
| 13 | 31.79 | 49.46 | 266 | 19.71 | 131 | <1 | <1 | <1 | 53.61 | 81.1 |
| 14 | 26 | 55 | 240 | 24 | 107 | 0.93 | < 0.1 | 0.37 | 55 | 75 |
| 15 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 16 | 21 | 51 | 220 | 18 | 74 | <0.5 | <1 | <1 | 45 | 68 |
| 17 | 28.91029 | 54.20963 | 217.0179 | 18.51755 | 81.24415 | <1 | 0.223703 | 0.395104 | 51.98257 | 87.36252 |
| 18 | 24.6 | 38 | 161.7 | 15.3 | 50 | <5 | <5 | <5 | 38 | 61.3 |
| 19 | 27.4 | 63.9 | 253.7 | 23.1 | 108.9 | <0.5 | <0.5 | 0.291 | 53.8 | 128 |
| 20 | 25 | 61.5 | 283 | 24.6 | 97 | <0.5 | <0.5 | <0.5 | 50.2 | 105 |
| 21 | 29 | 60 | 230 | 21 | 98 | <0.5 | <0.5 | <0.5 | 53 | 82 |
| 22 | 24.7 | 68.6 | 245 | 16.8 | 73.3 | <0.001 | <0.001 | 0.135 | 66.886 | 80.3 |
| 23 | 41.4 | 85.9 | 412 | 34.9 | 139.6 | <1 | <1 | <1 | 77.7 | 125 |
| 24 | <49 | 52.4 | 224 | 21.7 | 81.0 | <9.9 | <9.9 | <9.9 | 46.4 | 80.0 |
| 25 | <5 | 6.9 | 32 | <5 | 11 | <5 | <5 | <5 | 6.9 | 11 |
| 27 | 27 | 57 | 284 | 20 | 118 | 0.99 | <0.24 | 0.29 | 54 | 87 |
| 28 | 26 | 55 | 270 | 25 | 120 | < 10 | < 1 | < 2 | 50 | 120 |
| 29 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 30 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 31 | 23 | 55.1 | 222 | 20.5 | 74.5 | 0.7 | 0.2 | 0.4 | 46 | 75.8 |
| 32 | 26 | 59 | 270 | 24 | 94 | <10 | <10 | <10 | 49 | 98 |
| 33 | 27.01 | 76.07 | 290.00 | 22.65 | 104.52 | 0.80 | < 0.5 | 0.50 | 50.67 | 98.12 |
| 34 | 30 | 59 | 280 | 26 | 100 | <1 | <5 | <5 | 57 | 100 |
| 35 | 30 | 56 | 250 | 18 | 92 | 0.55 | 0.21 | 0.37 | 47 | 79 |
| 36 | 0.0267 | 0.0558 | 0.233 | 0.0186 | 0.083 | < 0.0010 | < 0.0010 | < 0.0010 | 0.0482 | 0.0806 |
| 37 | 27.81 | 58.29 | 220.31 | 22.5 | 86.89 | 0.85 | 8.55 | 0.45 | 53.1 | 142.2 |
| 38 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*AV = Assigned Value, NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score.

Table 85 Summary of Participants' Results and Performance for Sample S1* (continued)

| Lab. Code | PFHxS (µg/kg) | PFHxS_L (µg/kg) | PFHpS (µg/kg) | PFOS (µg/kg) | PFOS_L (µg/kg) | PFNS (µg/kg) | PFDS (µg/kg) | PFDoS (µg/kg) | PFOSA (µg/kg) | MeFOSAA (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|
| AV | 874 | 790 | Not Set | 11200 | 8020 | Not Set | Not Set | Not Set | 52.5 | 0.68 |
| 1 | 860 | 730 | 110 | 8800 | 6400 | 13 | 6.2 | NT | 42 | <1.0 |
| 2 | 835 | NT | 141 | 10300 | NT | 67.9 | 15 | 12.2 | 59.4 | 0.6 |
| 3 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 4 | 976.56 | NR | 84.877 | 9755.34 | NR | 10.583 | 3.186 | NR | 40.833 | <0.3 |
| 5 | 973.8108 | NT | 133.961 | 11557.79 | NT | NT | 2.94851 | NT | 46.96623 | 0.82169 |
| 6 | 637 | NT | 220 | 9912 | NT | 56 | <0.001 | <0.001 | 38 | <0.001 |
| 7 | 940 | 820 | 250 | 12400 | 8200 | 150 | 42 | NT | 60 | <5 |
| 8 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 9 | 927 | NT | 164 | 11300 | NT | 80.3 | 22.3 | NT | 59 | <2 |
| 10 | 890 | 805 | 145 | 10000 | 7500 | 28 | 13.5 | NT | 35 | <1 |
| 11 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 12 | 760 | 700 | 110 | 7400 | 5600 | 31 | 13 | 10 | 36 | NR |
| 13 | 1026 | 936 | 238 | 14099 | 9430 | <1 | <1 | <1 | 70.36 | <1 |
| 14 | 850 | 730 | 230 | 15900 | 9830 | 85 | 26 | NT | 57 | < 1 |
| 15 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 16 | 940 | NT | 110 | > 10000 | NT | 12 | 9 | 7.7 | 39 | 0.7 |
| 17 | 862.3291 | NT | 130.5812 | 10233.86 | NT | NT | 2.727738 | NT | 44.97126 | 0.868488 |
| 18 | 648.6 | NT | 86.6 | NT | NT | 12.9 | 5.6 | NT | 23.1 | <5 |
| 19 | 1011 | 903 | 248 | 12080 | 7740 | 33.1 | 8.11 | 3.12 | 62.7 | <1 |
| 20 | 938 | NT | 209 | 10500 | 6370 | 102 | 24.8 | 21.1 | 57.3 | <0.5 |
| 21 | 850 | 730 | 140 | 9300 | 6900 | 12 | 3.5 | 5.6 | 50 | <1.0 |
| 22 | 676 | NT | NR | 11779 | NT | 44.3 | <0.001 | <0.001 | 47 | <0.001 |
| 23 | 1480 | 1330 | 239 | 14579 | 10580 | 12.7 | 5.6 | NT | 73.6 | 1.5 |
| 24 | 788 | NT | 143 | 9460 | NT | 75.1 | 19.8 | NT | 45.4 | <9.9 |
| 25 | 120 | NT | 19 | 1100 | NT | NT | <5 | NT | 7 | <5 |
| 27 | 990 | 870 | 150 | 15000 | 11000 | 31 | 3.0 | 3.2 | 63 | 0.52 |
| 28 | 920 | 760 | 140 | 10000 | 7800 | 42 | 12 | 49 | 60 | < 5 |
| 29 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 30 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 31 | 720 | NR | 138 | 12000 | 8550 | 45.6 | 23 | 4.2 | 53.2 | 0.5 |
| 32 | 870 | 740 | 210 | 11000 | 8300 | <50 | <10 | <10 | 56 | <10 |
| 33 | 800.1 | 745.3 | 212.0 | 11881 | 7788 | 41.67 | 19.13 | NT | 62.76 | < 0.5 |
| 34 | 1000 | 880 | 180 | 12000 | 7600 | 74 | 22 | NT | 48 | <2 |
| 35 | 880 | 750 | 120 | 8900 | 7500 | 9.7 | 4.0 | 3.8 | 56 | 0.76 |
| 36 | 0.891 | 0.775 | 0.162 | 10.74 | 7.58 | 0.01064 | 0.00859 | 0.00722 | 0.0546 | < 0.0010 |
| 37 | 858.5 | 783.6 | 256.1 | 13220.8 | 8315.21 | 84.12 | 3.82 | NT | 58.15 | <1 |
| 38 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*AV = Assigned Value, NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score.

Table 86 Summary of Participants' Results and Performance for Sample S2*

| Lab. Code | PFBA (µg/kg) | PFPeA (µg/kg) | PFHpA (µg/kg) | PFOA (µg/kg) | PFNA (µg/kg) | PFUdA (µg/kg) | PFTeDA (µg/kg) | PFHxDA (µg/kg) | PFODA (µg/kg) | PFBS (µg/kg) | PFHxS (µg/kg) | PFHxS_L (µg/kg) | PFOS (µg/kg) | PFOS_L (µg/kg) | PFUdS (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AV | 2.00 | 2.41 | 1.70 | 2.29 | 1.93 | 4.40 | 0.635 | 6.2 | Not Set | 1.91 | 1.60 | 1.33 | 6.17 | 4.82 | Not Set |
| 1 | 2.0000 | 2.2 | 2 | 2.6 | <5.0 | <5.0 | NR | NT | NT | 2.3 | 1.6 | 1.3 | 7.8 | 5.9 | NT |
| 2 | 2 | 2.2 | 1.6 | 2.2 | 1.8 | 4 | 0.6 | NT | NT | 1.8 | 1.5 | NT | 5.5 | NT | NT |
| 3 | 1.799 | 2.109 | 1.483 | 1.939 | 1.705 | 3.663 | 0.576 | 4.922 | 2.276 | 1.646 | NT | 1.236 | 6.531 | 4.966 | NT |
| 4 | 2.3055 | 2.3308 | 1.626 | 2.474 | 1.872 | 4.788 | <0.5 | NT | NR | 2.053 | 1.641 | NR | 5.63 | NR | NR |
| 5 | 2.13219 | 2.63918 | 1.68076 | 2.38862 | 1.90088 | 4.40501 | 0.67117 | NT | NT | 2.02052 | 1.56162 | NT | 5.49041 | NT | NT |
| 6 | 1.9 | 2.2 | 1.5 | 2.1 | 2.1 | 2.1 | <0.001 | <0.001 | <0.001 | 1.8 | 1.6 | NT | 5.7 | NT | NT |
| 7 | 1.56 | 2.2 | 1.7 | 2.1 | 1.72 | 2.97 | 0.51 | NT | NT | 1.9 | 1.37 | 1.18 | 5.93 | 4.44 | NT |
| 8 | 1.862226 | 2.525643 | 1.566409 | 2.190279 | 1.754402 | 4.439790 | 0.607367 | 6.286888 | 2.383064 | 1.770771 | NT | 1.363320 | 6.182046 | 4.340504 | NT |
| 9 | 2.08 | 3.01 | 1.89 | 2.53 | 2.16 | 4.71 | 0.65 | 5.32 | NT | 2.05 | 1.48 | NT | 6.03 | NT | NT |
| 10 | 1.95 | 2.35 | 1.7 | 2.3 | 2 | 4.5 | <1 | NT | NT | 1.95 | 1 | 1.4 | 7 | 5.05 | NT |
| 11 | 2.004 | NR | NR | 2.302 | 1.914 | 4.25 | 0.748 | NR | NR | 1.834 | 1.684 | 1.437 | 6.355 | 4.842 | 16.298 |
| 12 | 2.4 | 2.1 | 1.6 | 2.2 | 1.8 | 4.1 | NR | 5.0 | NR | 1.7 | 1.5 | 1.3 | 5.5 | 4.4 | NT |
| 13 | 5.27 | 2.22 | <1 | 2.1 | 2.36 | 5.46 | <1 | 6.6 | 4.22 | <1 | 1.83 | 1.49 | 7.95 | 5.76 | NT |
| 14 | 1.7 | 3 | 2.1 | 2 | 1.9 | 4.3 | 0.54 | NT | NT | 2.1 | 1.6 | 1.3 | 6.7 | 4.9 | NT |
| 15 | NR | NR | NR | 2.33 | NR | NR | NR | NR | NR | NR | 1.58 | NR | 6.38 | NR | NR |
| 16 | 2.0 | 2.0 | 1.1 | 1.9 | 1.6 | 4.0 | <1 | NT | NT | 1.8 | 1.3 | NT | 4.5 | NT | NT |
| 17 | 2.157052 | 2.316359 | 1.561383 | 2.180426 | 1.972940 | 4.043732 | 0.695725 | NT | NT | 1.907470 | 1.459788 | NT | 5.962483 | NT | NT |
| 18 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | NT | NT | <5 | <5 | NT | NT | NT | NT |
| 19 | 2.12 | 2.34 | 1.62 | 2.52 | 1.8 | 4.84 | 0.785 | 8.63 | NT | 2.02 | 1.68 | 1.33 | 6.25 | 4.73 | NT |
| 20 | 2.09 | 2.72 | 1.72 | 2.44 | 1.93 | 4.04 | 0.598 | 5.82 | NT | 1.78 | 1.7 | NT | 5.89 | 3.87 | NT |
| 21 | 1.9 | 2.7 | 1.9 | 2.6 | 2.5 | 5.3 | 1 | 9 | 13 | 1.9 | 1.9 | 1.6 | 9.1 | 7.2 | 35 |
| 22 | 2.05 | 2.06 | 1.60 | 2.44 | 1.91 | 1.91 | <0.001 | <0.001 | <0.001 | 1.95 | 1.89 | NT | 5.57 | NT | NT |
| 23 | 2.3 | 2.7 | 2.1 | 2.8 | 2.2 | 4.7 | 1.3 | NT | NT | 2.3 | 2.2 | 1.9 | 8.7 | 6.4 | NT |
| 24 | 2 | 2.7 | 1.8 | 2.8 | 2.3 | 5.1 | 0.8 | NT | NT | 2.1 | 1.8 | NT | 6.9 | NT | NT |
| 25 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | NT | NT | <5 | <5 | NT | <5 | NT | NT |
| 27 | 1.9 | 2.2 | 1.5 | 2.3 | 1.9 | 3.9 | 0.65 | 6.9 | 3.3 | 1.8 | 1.5 | 1.3 | 6.3 | 5.0 | 16 |
| 28 | < 5 | 2 | 2 | 3 | 2 | 5 | < 10 | NT | NT | 2 | 2 | 1 | 6 | 5 | NT |
| 29 | 1.816 | 3.600 | 1.837 | 2.377 | 2.054 | 4.626 | 0.580 | 5.122 | 2.181 | 1.662 | 1.523 | 1.258 | 4.419 | 3.193 | 17.660 |
| 30 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 31 | 2 | 2.2 | 1.4 | 1.9 | 1.6 | 4.1 | <0.5 | 4.9 | NR | 1.7 | 1.3 | NR | 5.4 | 4.5 | NR |
| 32 | 1.8 | 2.0 | 1.5 | 2.2 | 1.8 | 4.0 | <1 | 33 | NT | 1.6 | 1.5 | 1.3 | 5.6 | 4.3 | NT |
| 33 | 2.132 | 3.352 | 1.554 | 2.264 | 1.821 | 4.816 | 0.593 | NT | NT | 1.969 | 1.607 | 1.455 | 6.795 | 5.129 | NT |
| 34 | 2.0 | 2.8 | 2.1 | 2.3 | 2.1 | 4.6 | <5 | NT | NT | 2.1 | 1.5 | 1.2 | 6 | 4.4 | NT |
| 35 | 2.2 | 2.4 | 1.6 | 2.1 | 1.9 | 4.3 | 0.68 | 6.9 | <0.07 | 1.8 | 1.6 | 1.3 | 6.5 | 4.8 | 16 |
| 36 | 0.00193 | 0.00241 | 0.00168 | 0.00251 | 0.00190 | 0.00420 | < 0.0010 | NT | NT | 0.00197 | 0.00156 | 0.001317 | 0.00594 | 0.00446 | NT |
| 37 | 1.82 | 2.3 | 1.8 | 2.02 | 1.92 | 4.03 | 0.56 | NT | NT | 2.1 | 1.63 | 1.21 | 6.13 | 4.3 | NT |
| 38 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*AV = Assigned Value; NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score.

Table 86 Summary of Participants' Results and Performance for Sample S2* (continued)

| Lab. Code | PFDoS (µg/kg) | PFTrDS (µg/kg) | PFOSA (µg/kg) | EtFOSA (µg/kg) | MeFOSAA (µg/kg) | MeFOSE (µg/kg) | 6:2FTS (µg/kg) | 10:2FTS (µg/kg) | 8:2diPAP (µg/kg) | 6:2FTOH (µg/kg) | 3:3FTCA (µg/kg) | GenX (µg/kg) | PFMPA (µg/kg) | 11Cl-PF3OUdS (µg/kg) | PFEESA (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AV | 9.6 | Not Set | 0.871 | 3.16 | 4.34 | 4.69 | 1.94 | 43.2 | Not Set | Not Set | Not Set | 13.8 | 26.0 | Not Set | 4.97 |
| 1 | NT | NT | <1.0 | 2.7 | 6.4 | 4.5 | 2.0 | NR | NT | NT | 21 | NR | NT | NR | NT |
| 2 | 6.8 | NT | 0.9 | 3 | 4.2 | 4.3 | 2.1 | 34.2 | 2.2 | NT | 15.8 | 15.5 | 20.2 | 2.4 | 4 |
| 3 | NT | NT | 0.712 | NT | 3.597 | NT | 1.597 | 49.078 | 2.345 | NT | NT | NT | NT | NT | NT |
| 4 | NR | NR | 1.012 | 3.477 | 4.862 | 5.076 | 3.041 | 43.565 | NR | NR | NR | 15.087 | NR | 2.11 | NR |
| 5 | NT | NT | 0.9795 | 3.49924 | 5.18156 | 4.50378 | 1.79144 | 39.34482 | NT | NT | NT | 11.364 | NT | 2.31864 | NT |
| 6 | <0.001 | NT | 0.76 | 2.4 | 2.4 | 2.8 | 2.0 | 17 | NT | NT | NT | NT | NT | NT | NT |
| 7 | NT | NT | 0.79 | 2.9 | 2.98 | 3.71 | 1.7 | 43 | NT | NT | 1.7 | 10.5 | NT | 1.9 | NT |
| 8 | NT | NT | 0.787227 | 3.260939 | < 0.1 | NT | 1.799503 | 44.55901 | 1.943908 | NT | NT | 13.48335 | NT | NT | NT |
| 9 | NT | NT | 0.94 | 3.51 | 4.29 | 4.52 | 2.15 | 41.4 | NT | NT | NT | NT | NT | NT | NT |
| 10 | NT | NT | <1 | <1 | <1 | 4.7 | <5 | NT | NT | NT | NT | <1 | NT | NT | NT |
| 11 | 11.021 | 10.319 | NR | NR | NR | NR | 1.918 | NR | NR | NR | NR | 12.999 | NR | 2.51 | NR |
| 12 | 8.5 | NT | NR | 2.4 | 4.4 | NR | 1.8 | 38 | NR | NT | 61 | 12 | 20 | 2.2 | 4.3 |
| 13 | 8.41 | NT | <1 | 3.88 | 4.59 | 5.7 | 3.18 | 50.88 | <2 | NT | 15.26 | 18.66 | 34.63 | <2 | 5.17 |
| 14 | NT | NT | 0.76 | 3.2 | 3.5 | 4.3 | 1.9 | 44 | NT | NT | NT | NT | NT | NT | NT |
| 15 | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR | NR |
| 16 | 7.5 | NT | 1.0000 | 3 | 5.2 | <50 | 1.8 | 47 | NT | NT | NT | NT | NT | NT | NT |
| 17 | NT | NT | 1.164566 | 3.509741 | 4.834703 | 5.306931 | 1.523630 | 36.89370 | NT | NT | NT | 12.97902 | NT | 1.940443 | NR |
| 18 | NT | NT | <5 | <5 | <5 | <5 | <5 | 45.2 | NT | NT | NT | NT | NT | NT | NT |
| 19 | 5.73 | NT | 0.887 | 3.26 | 4.34 | 4.43 | 1.98 | 33 | 2.15 | NT | 14.1 | 15.4 | 20.8 | 1.99 | 5.53 |
| 20 | 12.5 | NT | 0.9 | 3.44 | 3.93 | 5.13 | 2.13 | 44.1 | 2.43 | 2.75 | 18.7 | 13.2 | 22.4 | 1.44 | 3.98 |
| 21 | 18 | 34 | 0.9 | 3.2 | 5.5 | 4.9 | 2 | 65 | 5 | <10 | 18 | 15 | 34 | <10 | 5.5 |
| 22 | <0.001 | NT | 0.75 | 1.40 | 2.48 | 0.87 | 2.35 | 15.35 | NT | NT | NT | NT | NT | NT | NT |
| 23 | NT | NT | 1.2 | 3.4 | 6.7 | 6 | 2.7 | 63.1 | NT | NT | NT | 16.4 | NT | 2.9 | NT |
| 24 | NT | NT | 0.9 | 4.2 | 6.5 | 5.1 | 2.6 | 35.6 | 2.9 | NT | 22.2 | 13.1 | 26.9 | 2.2 | 5.0 |
| 25 | NT | NT | <5 | <5 | <5 | <5 | 65 | 12 | NT | NT | NT | NT | NT | NT | NT |
| 27 | 10 | 8.3 | 0.88 | 3.2 | 4.7 | 4.8 | 1.8 | 58 | 1.0 | <5 | NT | 17 | 28 | 2.5 | 5.6 |
| 28 | 13 | NT | < 10 | < 5 | 5 | 5 | < 20 | 32 | 2 | NT | 11 | 14 | 31 | 3 | 6 |
| 29 | 12.245 | 20.710 | 0.634 | 2.381 | 2.814 | NT | NT | NT | 1.421 | 2.079 | NT | 9.878 | NT | 1.249 | NT |
| 30 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 31 | 7.9 | NR | 0.8 | 3.1 | 3.8 | 3.6 | 1.7 | 36.7 | 1.2 | NR | 13 | 14.4 | 20.6 | 2.5 | 4.4 |
| 32 | 11 | NT | <1 | 2.9 | 5.1 | <1 | 1.8 | 42 | NT | NT | 15 | 15 | 25 | 2.0 | 5.0 |
| 33 | NT | NT | 0.893 | 3.478 | 4.277 | 4.739 | 2.092 | 51.008 | NT | NT | 13.724 | 14.537 | NT | 2.995 | NT |
| 34 | NT | NT | <1 | 2.8 | 4.8 | 5.6 | 2.2 | 56 | NT | NT | 16 | 12 | 29 | 2.5 | 5.1 |
| 35 | 9.8 | 9.1 | 0.85 | 3 | 4.3 | NT | 1.8 | 44 | 1.9 | NT | NT | 14 | NT | 2.2 | NT |
| 36 | 0.00751 | NT | < 0.0010 | 0.0027 | 0.00431 | 0.00378 | 0.00176 | 0.0481 | NT | NT | 0.0169 | 0.0125 | 0.0282 | 0.00208 | 0.00472 |
| 37 | NT | NT | 0.85 | 3.18 | 3.68 | 3.86 | 1.88 | 41.48 | NT | NT | NT | 11.1 | NT | 2.01 | NT |
| 38 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*AV = Assigned Value; NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score.

Table 87 Summary of Participants' Results and Performance for Sample S3*

| Lab. Code | PFBA (µg/kg) | PFPeA (µg/kg) | PFHxA (µg/kg) | PFHpA (µg/kg) | PFOA (µg/kg) | PFNA (µg/kg) | PFDA (µg/kg) | PFDoA (µg/kg) | PFTrDA (µg/kg) | PFTeDA (µg/kg) | PFBS (µg/kg) | PFHxS (µg/kg) | PFHxS_L (µg/kg) | PFHpS (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AV | 11.1 | 5.92 | 4.39 | 3.69 | 8.40 | 5.92 | 12.4 | Not Set | 8.9 | 13.4 | 6.58 | 2.92 | 2.84 | 11.1 |
| 1 | 10 | 5.4 | 4.4 | 4.1 | 8.6 | 8.8 | 15 | <1.0 | 8.4 | NR | 7.2 | 2.8 | 2.8 | 7.3 |
| 2 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 3 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 4 | 11.939 | 7.435 | 4.724 | 3.577 | 7.78 | 5.834 | 13.13 | 1.18 | 9.267 | 17.712 | 5.547 | 3.16 | NT | 12.597 |
| 5 | 13.16708 | 7.37518 | 4.71813 | 3.51206 | 8.91486 | 5.55499 | 12.85349 | 0.80142 | 10.22704 | 17.70834 | 7.41029 | 2.6596 | NT | 10.33678 |
| 6 | 8.5 | 4.5 | 3.4 | 3.5 | 7.6 | 6.5 | 9.1 | <0.001 | 4.2 | 5.4 | 5.5 | 3.0 | NT | 11.8 |
| 7 | 14.24 | 4.04 | 4.24 | 3.57 | 6.48 | 5.25 | <0.1 | <0.1 | 7.74 | 13.04 | <0.1 | 2.82 | 2.1 | <0.1 |
| 8 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 9 | 9.77 | 7.92 | 4.65 | 3.77 | 8.81 | 6.05 | 14.1 | <0.5 | 9.05 | 10.3 | 6.7 | 2.91 | NT | 10.5 |
| 10 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 11 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 12 | NR | 7.6 | 4.5 | 3.5 | 8.3 | 5.3 | 11 | NR | 11 | 15 | 6.1 | 2.9 | 2.8 | 12 |
| 13 | <10 | 7.49 | <5 | <5 | 8.76 | 6.14 | 10.81 | <5 | 19.4 | 13.88 | <5 | <5 | <5 | 8.82 |
| 14 | 9.5 | 4.8 | 4.7 | 3.5 | 7 | 4.9 | 13 | 0.35 | 7.1 | 7.9 | 6.2 | 3 | 3 | 12 |
| 15 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 16 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 17 | 11.99567 | 6.636640 | 3.671104 | 4.864584 | 8.617869 | 6.243426 | 13.06322 | 0.878751 | 11.90100 | 17.54406 | 7.245218 | 2.387625 | NT | 12.21158 |
| 18 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 19 | <0.1 | 5.02 | 4.71 | 3.41 | 9.74 | 6.33 | 12.7 | 0.721 | 11.4 | 18 | 7.13 | 2.92 | 2.92 | 11.77 |
| 20 | <10 | 3.7 | 2.8 | <2.5 | 5.19 | 3.64 | 8.67 | <2.5 | 5.19 | 8.97 | 3.33 | <2.5 | NT | 8.61 |
| 21 | 9 | 13 | 3.9 | 3.6 | 8.1 | 5.2 | 13 | 0.6 | 12 | 25 | 5.6 | 2.8 | 2.8 | 13 |
| 22 | 9.90 | 5.56 | 3.32 | 4.05 | 8.75 | 8.20 | 13.77 | <0.001 | 2.01 | 5.88 | 6.73 | 3.61 | NT | 11.80 |
| 23 | 13.7 | 9.4 | 6.3 | 5.3 | 12.1 | 8 | 19.8 | <1 | 14.5 | 23.2 | 8.4 | 5.4 | 5.4 | 16.1 |
| 24 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 25 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | <5 | NT | <5 |
| 27 | 29 | 15 | 13 | 10 | 26 | 19 | 42 | 1.9 | 37 | 38 | 19 | 8.6 | 8.6 | 36 |
| 28 | 11 | 5 | 5 | 4 | 10 | 6 | 14 | < 20 | < 70 | < 100 | 7 | 3 | 3 | 11 |
| 29 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 30 | 2.5 | 5.78 | 4.8 | 2.88 | 1.7 | 0.8 | 13.2 | 0.57 | 6.16 | 7.41 | 5.78 | NR | 0.61 | 9.65 |
| 31 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 32 | 11 | 4.9 | 3.7 | 3.1 | 7.9 | 5.2 | 12 | <1 | 6.3 | 16 | 5.4 | 2.6 | 2.4 | 8.3 |
| 33 | 10.11 | 5.42 | 4.67 | 3.25 | 8.37 | 5.82 | 9.31 | < 0.5 | 15.00 | 8.50 | 5.49 | 2.80 | 2.80 | 10.48 |
| 34 | 9.3 | 7.4 | 4.3 | 4.2 | 9.3 | 6.5 | 16 | 0.8 | 10 | 17 | 8.2 | 3.2 | 3.2 | 13 |
| 35 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 36 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 37 | 13.73 | 4.53 | 4.52 | 3.77 | 7.88 | 5.14 | 10.2 | <0.5 | 8.1 | 12.32 | 7.15 | 3.25 | 3.1 | 12.2 |
| 38 | NT | 14 | 5.8 | 13 | 28 | 19 | 45 | NT | NT | NT | 17 | 9.6 | 9.6 | 40 |

*AV = Assigned Value; NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score.

Table 87 Summary of Participants' Results and Performance for Sample S3* (continued)

| Lab. Code | PFOS (µg/kg) | PFOS_L (µg/kg) | PFNS (µg/kg) | PFDS (µg/kg) | PFDoS (µg/kg) | PFOSA (µg/kg) | EtFOSAA (µg/kg) | 6:2FTS (µg/kg) | 6:2diPAP (µg/kg) | 8:2diPAP (µg/kg) | 5:3FTCA (µg/kg) | GenX (µg/kg) | ADONA (µg/kg) | 11Cl-PF3OUdS (µg/kg) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AV | 11.4 | 9.2 | 1.09 | 25.5 | Not Set | 5.10 | 18.1 | 5.04 | Not Set | Not Set | Not Set | 39.6 | 34.9 | 20.1 |
| 1 | 13 | 10 | <5.0 | 20 | NT | 5 | 17 | NR | NT | NT | 6.6 | 49 | 34 | NR |
| 2 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 3 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 4 | 10.313 | NT | 1.463 | 27.25 | NT | 5.586 | 21.863 | 5.623 | NT | NT | NT | 36.731 | 33.855 | 16.53 |
| 5 | 9.91914 | NT | NT | 30.81425 | NT | 4.89507 | 23.10887 | 5.22405 | NT | NT | NT | 34.1807 | 30.92949 | 17.03269 |
| 6 | 11 | NT | 0.57 | 22 | 20 | 4.1 | 32 | 4.6 | NT | NT | NT | NT | 49 | NT |
| 7 | <0.1 | <0.1 | <0.1 | <0.1 | NT | 6.24 | 13.76 | 4.3 | NT | NT | 0.84 | 36 | 25.14 | 21.77 |
| 8 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 9 | 14.7 | NT | <2 | 33 | 24.7 | 5.13 | 16.0 | 4.67 | 25.0 | 21.9 | 6.13 | 42.4 | 37.7 | 14.3 |
| 10 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 11 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 12 | 9.6 | 8.1 | 1.2 | NR | 16 | 4.5 | 19 | 5.4 | 19 | 20 | 11 | 36 | 44 | 24 |
| 13 | 8.91 | 6.77 | <5 | 9.53 | 19.17 | 7.99 | 22.39 | 7.48 | NT | 32.24 | <50 | 45.99 | 28.05 | <10 |
| 14 | 13.7 | 10.8 | 0.84 | 24 | NT | 4.2 | 11 | 4.5 | NT | NT | NT | NT | NT | NT |
| 15 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 16 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 17 | 10.90803 | NT | NT | 29.89830 | NT | 5.277983 | 26.18771 | 4.530528 | NT | NT | NT | 41.10244 | 30.44044 | 18.33510 |
| 18 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 19 | 12.6 | 9 | 1.12 | 21.6 | 13 | 5.55 | 18.6 | 5.45 | 22.6 | NR | 11.9 | 48.3 | 38.5 | 13.6 |
| 20 | 7.53 | 6.28 | <2.5 | 28.6 | 30.3 | 3.47 | 12.06 | 2.97 | 15.8 | 17.3 | 5.2 | 24.7 | 20.4 | 7.5 |
| 21 | 15 | 12 | 2.2 | 40 | 37 | 4.3 | 20 | 4.9 | 35 | 35 | 8 | 17 | 36 | 30 |
| 22 | 10.50 | NT | 0.77 | 11.65 | 16.46 | 4.13 | 11.47 | 7.15 | NT | NT | NT | NT | 69.48 | NT |
| 23 | 18.6 | 13.9 | 1.6 | 45.4 | NT | 6.7 | 29.7 | 8.7 | NT | NT | NT | 52.1 | 54.5 | 30.7 |
| 24 | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT | NT |
| 25 | <5 | NT | NT | <5 | NT | <5 | <5 | 14 | NT | NT | NT | NT | NT | NT |
| 27 | 33 | 28 | 3.2 | 94 | 42 | 15 | 60 | 15 | 106 | 104 | 29 | 139 | 140 | 64 |
| 28 | 13 | 10 | 1 | 27 | 6 | < 100 | 23 | < 20 | NT | 7 | 11 | 43 | 85 | 21 |
| 29 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 30 | 8.7 | 7.14 | 0.29 | 18.3 | 13.8 | 5.24 | 3.15 | 0.98 | 4.72 | NR | 0.78 | 18.7 | 4.99 | 2.65 |
| 31 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 32 | 9.3 | 7.9 | 1.1 | 23 | 16 | 4.5 | 17 | 5.1 | NT | NT | 4.9 | 38 | 36 | 17 |
| 33 | 10.15 | 8.19 | 0.66 | 10.49 | NT | 5.42 | 15.16 | 4.24 | NT | NT | 1.44 | 29.61 | 27.57 | 26.86 |
| 34 | 13 | 9.5 | 1.3 | 38 | NT | 6 | 23 | 6.2 | NT | NT | 7.2 | 33 | 46 | 21 |
| 35 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 36 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 37 | 13.97 | 11.2 | 0.98 | 15.56 | NT | 6.62 | 15.35 | 4.49 | NT | NT | NT | 41.54 | 26.87 | 22.32 |
| 38 | NT | NT | 4.1 | NT | NT | NT | NT | 18 | NT | NT | NT | NT | NT | NT |

*AV = Assigned Value; NS = Not Supplied, NT = Not Tested, NR = Not Reported. Shaded cells are results which returned a questionable or unacceptable *z*-score

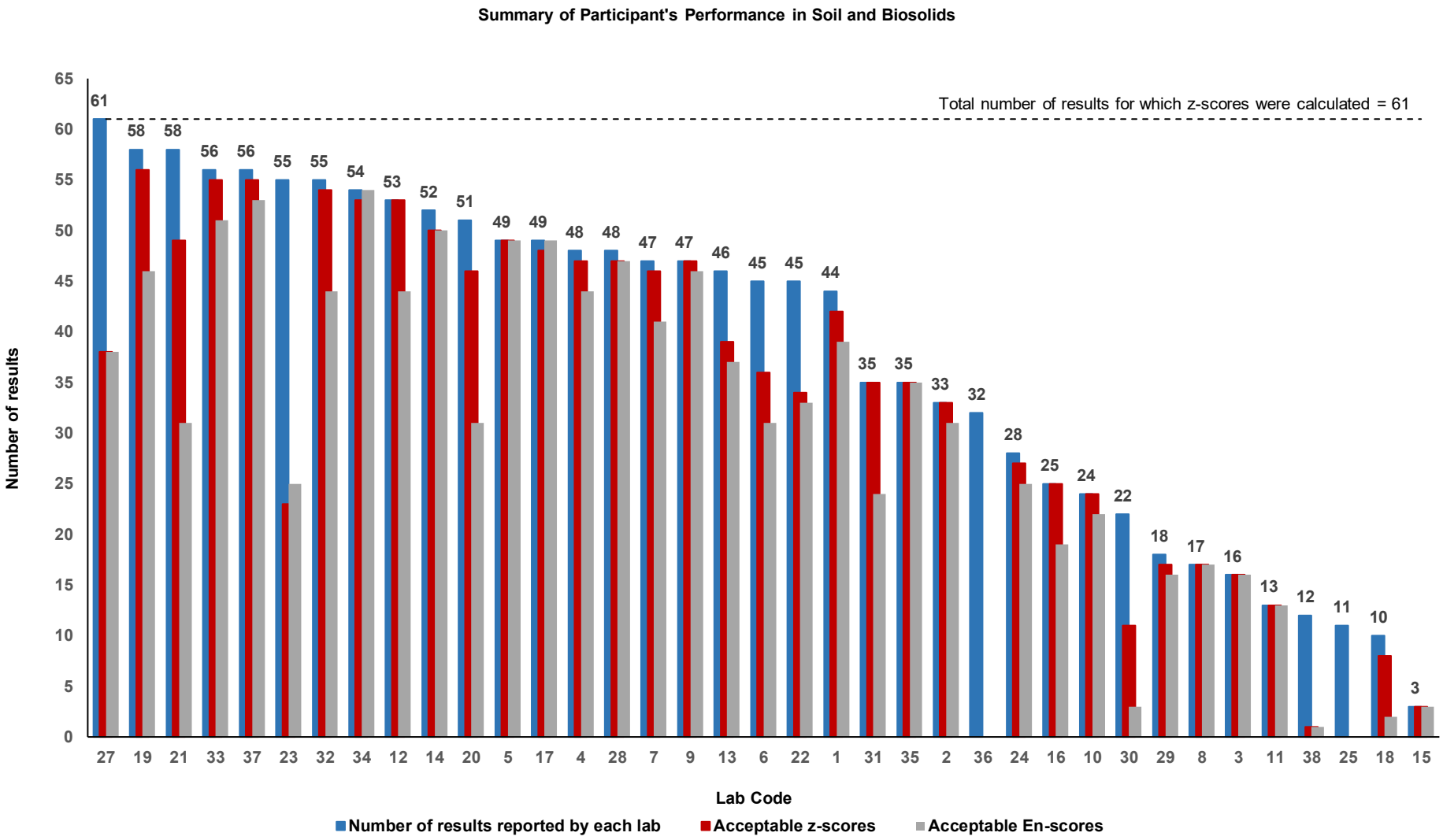



Figure 85 Summary of Participants' Performance in Soil and Biosolids

## 6.6 Participants' Results and Analytical Methods for PFAS in Soil

Thirty-five participants reported results for at least one of the two soil samples. Participants were requested to analyse the samples using their routine test method and report a single result as they would normally report to a client. The method descriptions provided by participants for PFAS measurements in soil are presented in Appendix 6.

Sample S1 was contaminated (incurred) soil, whereas Sample S2 was soil fortified for 30 individual PFAS analytes. Overall, the between-laboratory coefficients of variation for PFAS analytes in Sample S1 were larger than those of Sample S2, an indication that PFAS measurements in the incurred soil presented more difficulty to participants than in the fortified soil.

### Extraction

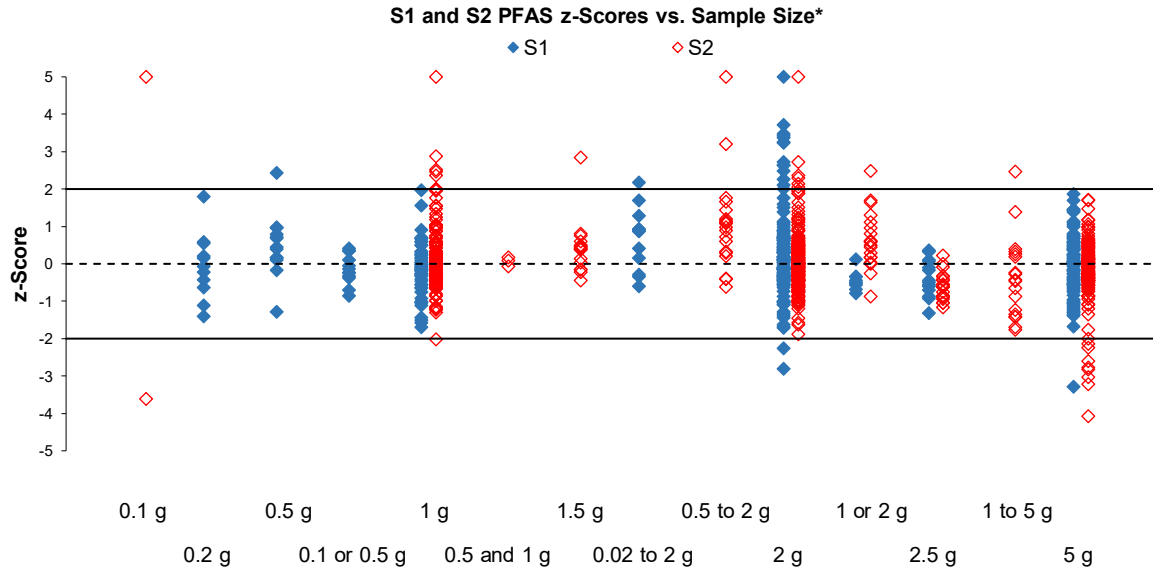
Two participants homogenised the soil sample before subsampling. Of the results reported by these two participants, 56 out of 57 returned acceptable *z*-scores.

USEPA Method 1633A notes that small amounts of water can be added to dry soil samples to facilitate extraction.[9] Five participants reported wetting the soil prior to analysis. Overall, a better recovery of the spike value was noticed for 4 of these participants.

Analytes' mass fraction in Sample S1 other than PFOS were between 0.392 µg/kg and 874 µg/kg (mass fractions for PFOS_L was 8020 µg/kg and for PFOS was 11200 µg/kg). For Sample S2, the mass fractions were between 0.635 µg/kg and 43.2 µg/kg.

Twenty out of 24 participants who reported results for both soil samples used the same (or similar) sample size.

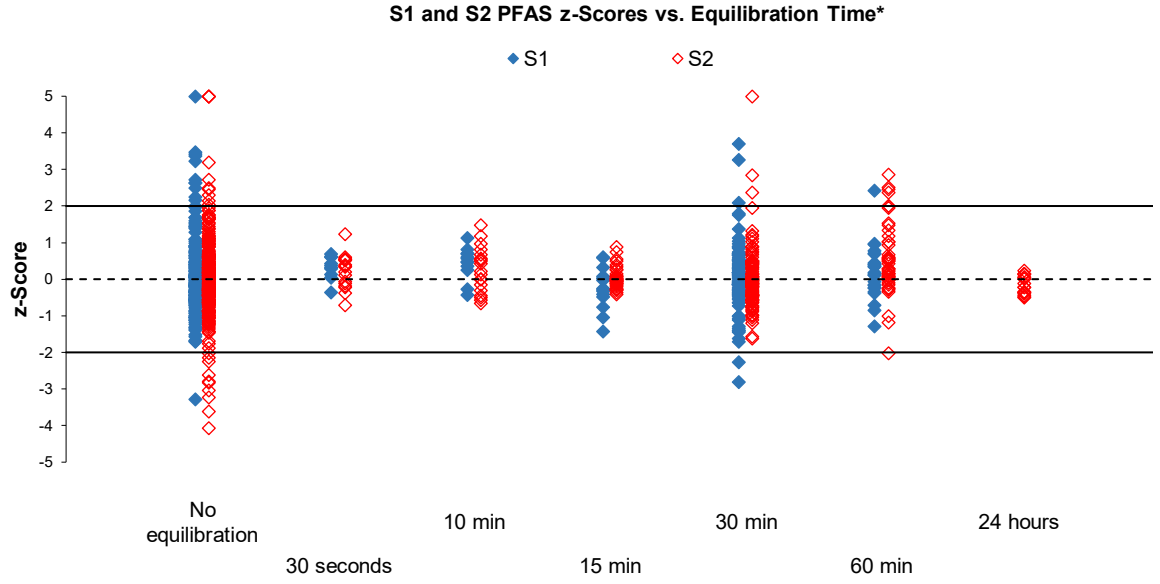
Participants used a wide variety of sample sizes from 0.02 g to 5 g in Sample S1 and from 0.1 g to 5 g in Sample S2. Plots of participants' performance in Samples S1 and S2 versus the amount of sample taken for analysis are presented in Figure 86. Caution should be exercised when a small sample size is taken for analysis as this might not be representative of the whole sample. It should be also noted that homogeneity of these PT samples may not reflect the homogeneity of routine samples encountered by laboratories.




*Scores greater than 5.0 have been plotted as 5.0

Figure 86 S1 and S2 PFAS z-Scores vs Sample Size

All participants reported adding isotopically labelled internal standards before extraction and 15 of them left the sample to equilibrate. Plots of participants' z-scores versus equilibration time are presented in Figure 87. No significant differences were evident between the performance of those participants who left the sample to equilibrate and those who didn't.



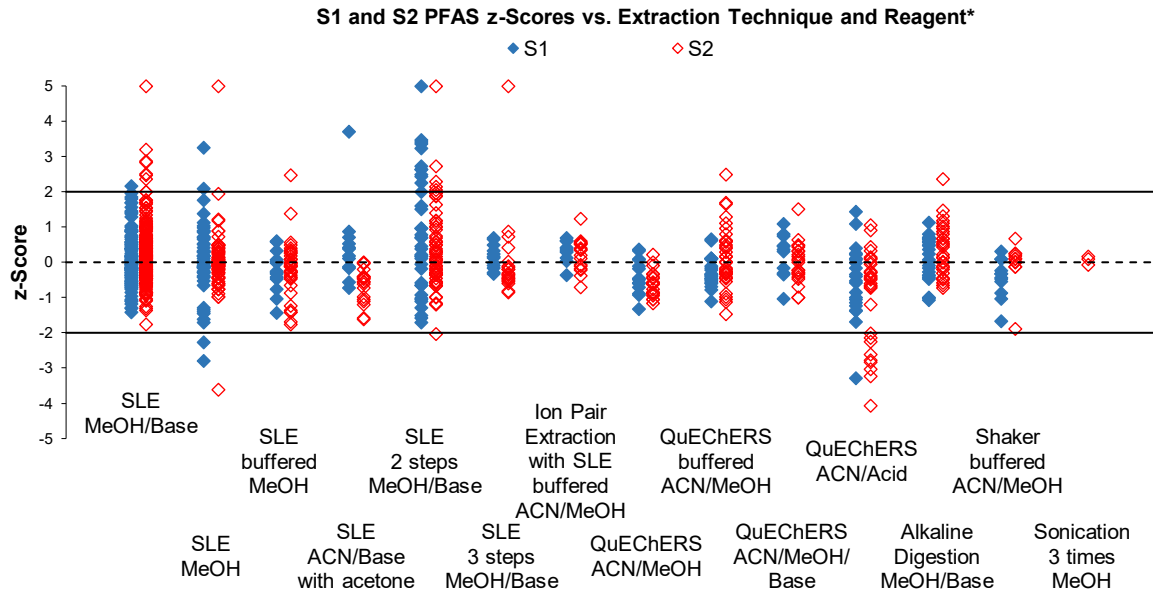

*Scores greater than 5.0 have been plotted as 5.0

Figure 87 S1 and S2 PFAS z-Scores vs Equilibration Time

Laboratories **7**, **11**, **15**, **21**, **23**, **24**, **27**, and **31** did not correct the results for the internal standard recovery. The results reported by these laboratories were biased high, with the exception of those reported by Laboratories **7** and **31** (Figure 80).

Methanol and base modified methanol were the preferred extraction reagents. Participants used a wide variety of extraction procedures, such as those based on SLE, QuEChERS, alkaline digestion, and/or ion pair extraction. The use of mass labelled standards likely played a significant role in correcting the difference between these in-house analytical methods.

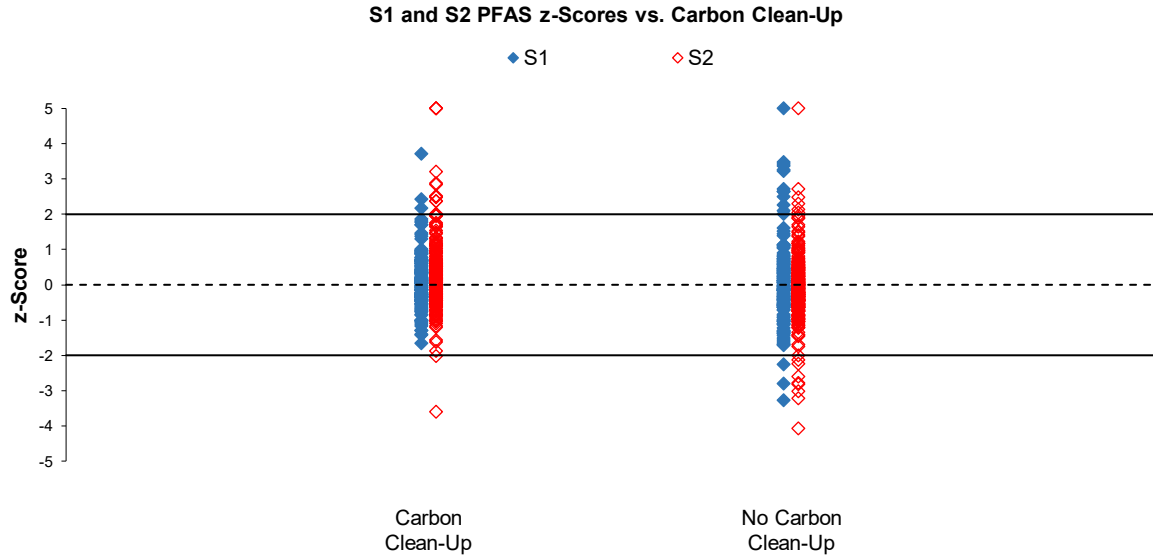
Five participants reported using a staggered extraction: three conducted SLE over two steps, one used a staggered SLE over three steps, and one sonicated their sample across 3 rounds. There may be a relationship between some PFAS results biased low and ACN used as extraction reagent (Figure 88). ACN may not be an efficient solvent for desorbing PFAS that have migrated into soil pores. Extraction studies found that long chain PFAS (>C8) including PFAAs remain 'incorporated into soil matter' and are difficult to remove. ACN alone has limited ability to disrupt these strong hydrophobic/hydrophilic interactions.[10]




*Scores greater than 5.0 have been plotted as 5.0

Figure 88 S1 and S2 PFAS z-Scores vs Extraction Technique and Reagent

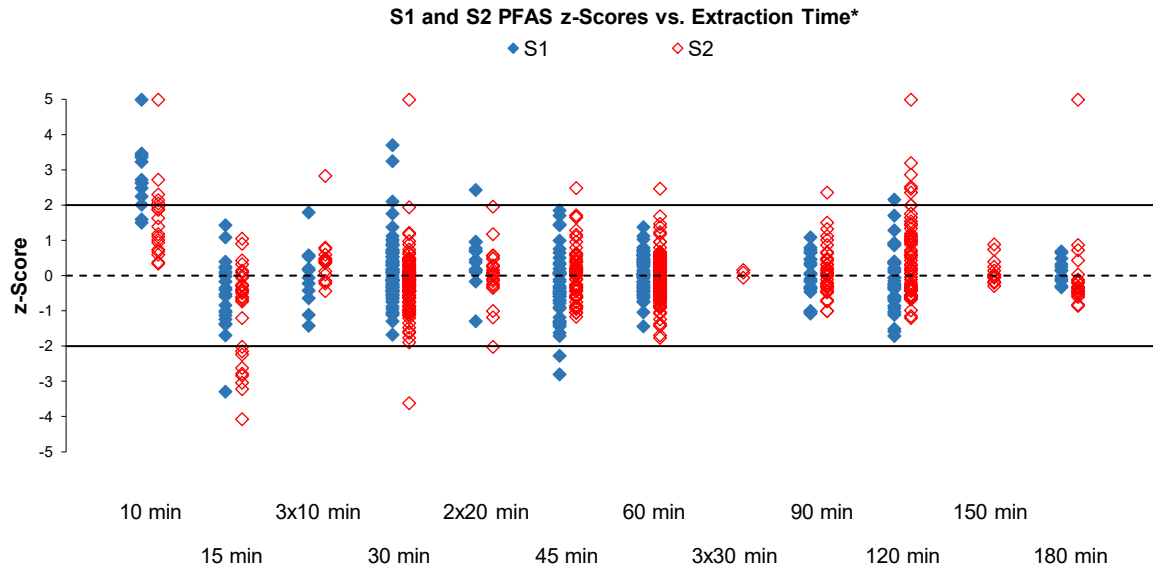
Fifteen participants added loose carbon to the sample extract to facilitate better adsorption of interferent organics.[9] A higher variability in results was observed from the participants not using a carbon clean-up step (Figure 89).




*Scores greater than 5.0 have been plotted as 5.0.

Figure 89 S1 and S2 PFAS z-Scores vs Carbon Clean-Up

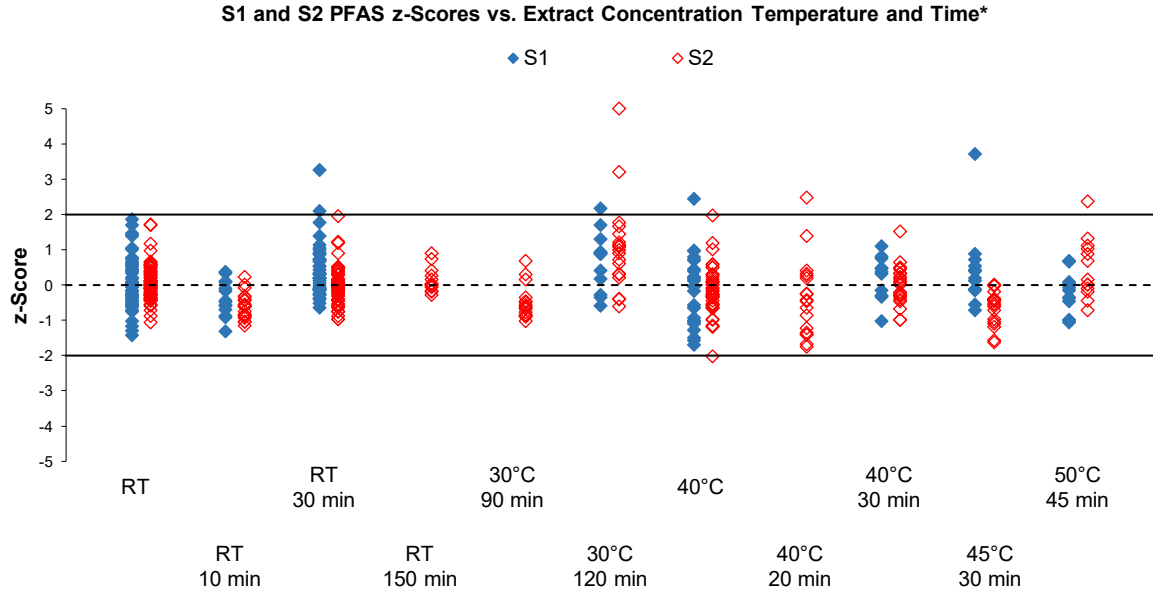
Laboratories reported extracting their sample for 10 to 180 minutes, with most participants performing extraction for 30 to 60 minutes (Figure 90). In this study, one participant extracted for 10 minutes and returned results that were biased high. This observed bias may be due to problems with sample preparation dilution calculations or standard preparation procedures.




*Scores greater than 5.0 have been plotted as 5.0.

Figure 90 S1 and S2 PFAS z-Scores vs Extraction Time

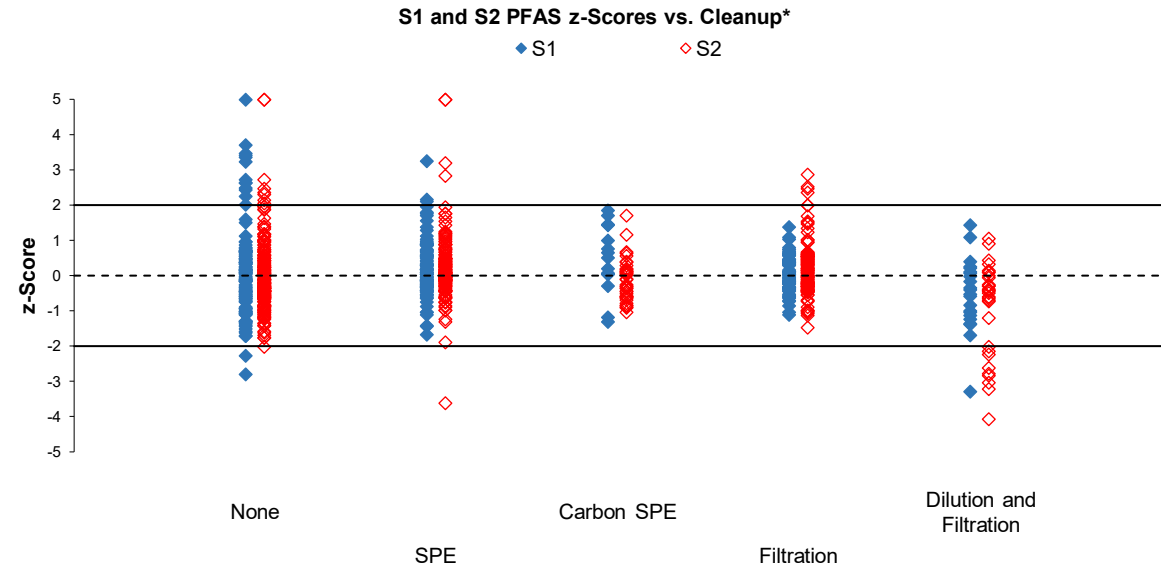
Six participants concentrated their sample extract at a temperature of 40°C to 50°C (Figure 91). According to the USEPA Method 1633A, if all methanol is evaporated then the extract can be too concentrated and/or losses of neutral compounds can occur (FOSEs and FOSAs). Alternatively, if excess methanol is present during SPE cleanup then long chain carboxylic acids and sulfonates are likely to have poor recovery.[9]




*Scores greater than 5.0 have been plotted as 5.0. RT = Room Temperature

Figure 91 S1 and S2 PFAS z-Scores vs Extract Concentration Temperature and Time

Cleanup of the crude extracts is an important step in the removal of matrix constituents that may interfere in instrumental determination. Many participants performed a clean-up step, with SPE, filtration and/or dilution being reported. Twelve participants did not cleanup after extraction (Figure 92).




*Scores greater than 5.0 have been plotted as 5.0

Figure 92 S1 and S2 PFAS z-Scores vs Extraction Cleanup Procedure

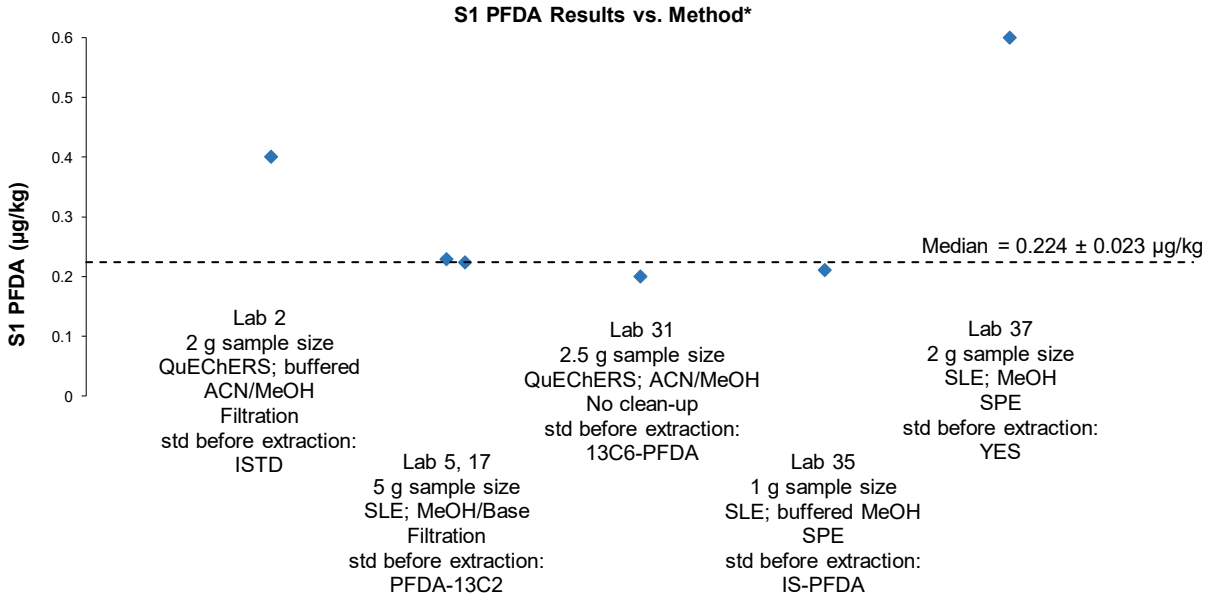
**Instrumental Technique**

The analytical detection method of choice was LC-MS/MS. Laboratories **6**, **22**, and **28** used LC-Orbitrap instead. There was no significant difference between the participants' results obtained using the two instrumental techniques.

### 6.6.1 Individual PFCA Analytes in Soil

Overall measurement of most PFCAs in the two soil samples did not challenge participants' analytical techniques; the between-laboratory CVs varied from 8.5% to 24%. PFODA was an exception with between-laboratory CV of 48%.

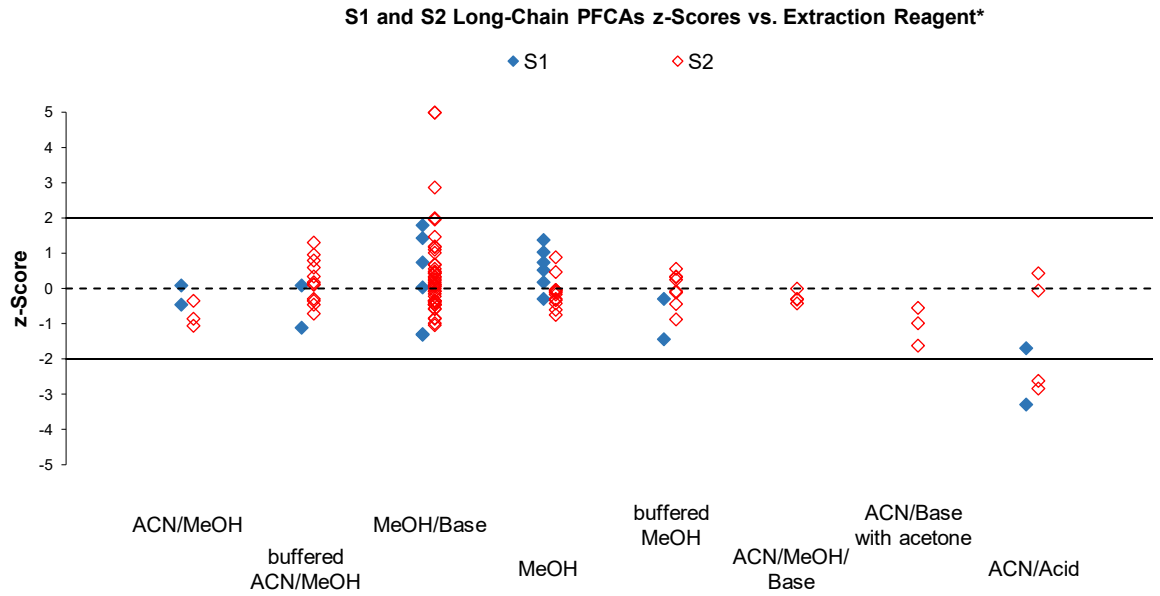
**PFDA** level in Sample S1 was low (median excluding extreme outliers was 0.224 µg/kg), below the level of reporting of many laboratories. Only six participants reported numeric results with four of them in excellent agreement with each other (Figure 93).




*Result greater than 0.6 µg/kg has been plotted at 0.6 µg/kg.

Figure 93 S1 PFDA Results vs Method

**Long Chain PFCAs** Participants' performance for the long-chain PFCA analytes (PFNA, PFUdA, PFDoA, PFTeDA, PFHxDA) by extraction reagent is presented in Figure 94. There may be a relationship between low-biased results and the use of ACN, particularly in the absence of methanol, as the extraction reagent. PFAS extraction from soil requires strong solvent-matrix disruption and ACN has limited ability to disrupt strongly bound PFAS from soil matrices.[10]




*Scores greater than 5.0 have been plotted as 5.0

Figure 94 S1 and S2 Long-Chain PFCAs z-Scores vs Extraction Reagent

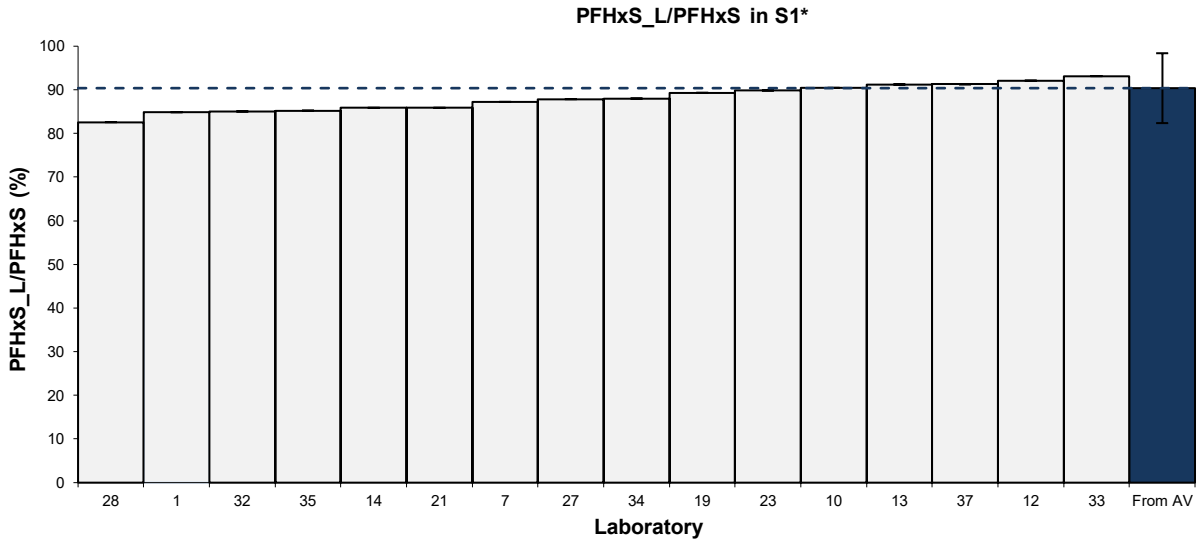
**PFODA** spiked value in Sample S2 was 5.36 µg/kg. Only six participants reported numerical results for this analyte, and most of these results were less than half of the spiked value. Because labelled PFODA standards are not commercially available, laboratories either used $^{13}$C-PFHxDA or no labelled standard at all, making accurate recovery assessment difficult. Several laboratories reported results below half of the spiked value or below their reporting limits (0.07 µg/kg or 0.001 µg/kg). Laboratories should review their methodology, as PFODA can be lost during extraction depending on the composition of the extraction solvent.

### 6.6.2 Individual PFSA Analytes in Soil

Overall, measurement of medium-chain PFSAs in the two soil samples did not challenge participants' analytical techniques, however there was more variability in participants' results for the long-chain PFSAs, particularly in the incurred soil sample S1.

**PFHxS**, **PFHxS_L**, **PFOS**, and **PFOS_L** Participants were asked to report both total (the sum of linear and branched isomers) and linear (the linear isomer only) results.

For incurred soil sample S1, 16 participants reported results for both total and linear PFHxS. The ratios of linear PFHxS versus total PFHxS in S1 were between 83% and 93%, while the expected ratio from the assigned values was 90% (Figure 95).

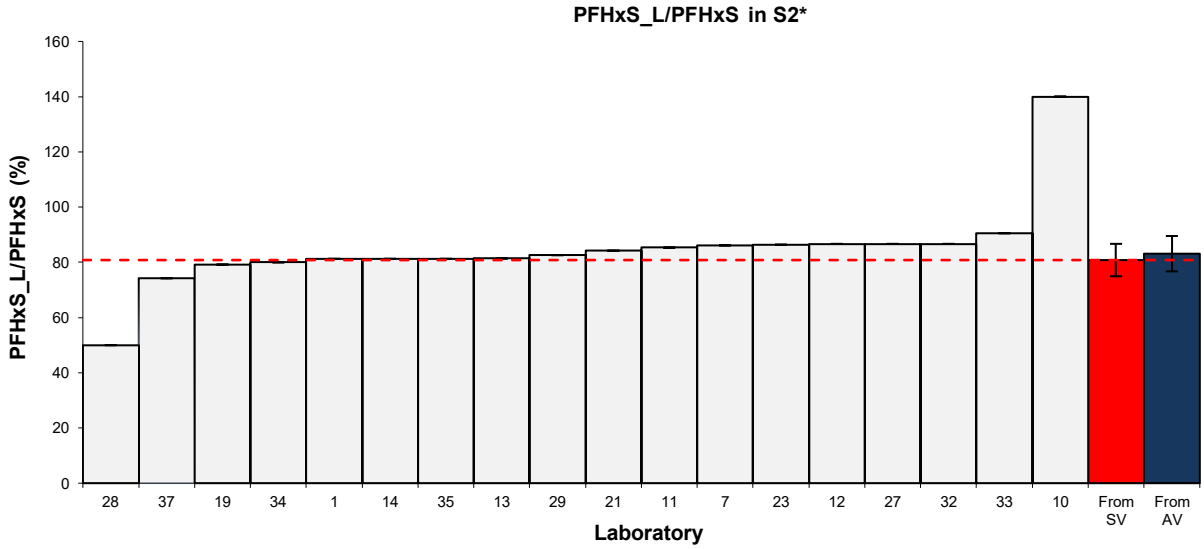



*The ratio from the AV is calculated based on the results reported by all participants including those who reported results for only one analyte.

Figure 95 Bar Charts of PFHxS_L/PFHxS in S1

The soil sample S2 was spiked with a PFHxS standard containing both branched and linear PFHxS. The ratio of linear PFHxS to total was expected to be 81%, while the ratio calculated based on participants' results was similar at 83%.

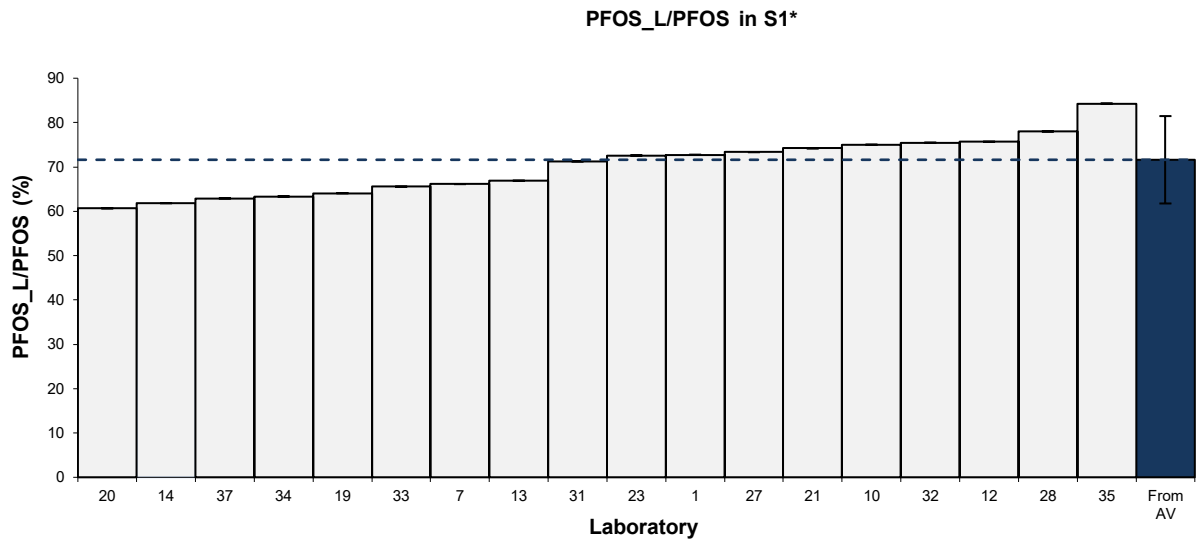
Eighteen participants reported results for both PFHxS total and linear in this sample. With the exception of Laboratory **10**, the linear to total ratio was between 50% and 91% (Figure 96). Laboratory **10** reported a greater value for PFHxS linear as compared to PFHxS total (ratio of 140%); this participant may have switched their results for these two tests.




*The ratio from the AV is calculated based on the results reported by all participants including those who reported results for only one analyte.

Figure 96 Bar Charts of PFHxS_L/PFHxS in S2

For incurred soil sample S1, 18 participants reported results for both total and linear PFOS. The ratios of linear PFOS versus total PFOS in S1 were between 61% and 84%, while the expected ratio from the assigned values was 72% (Figure 97).

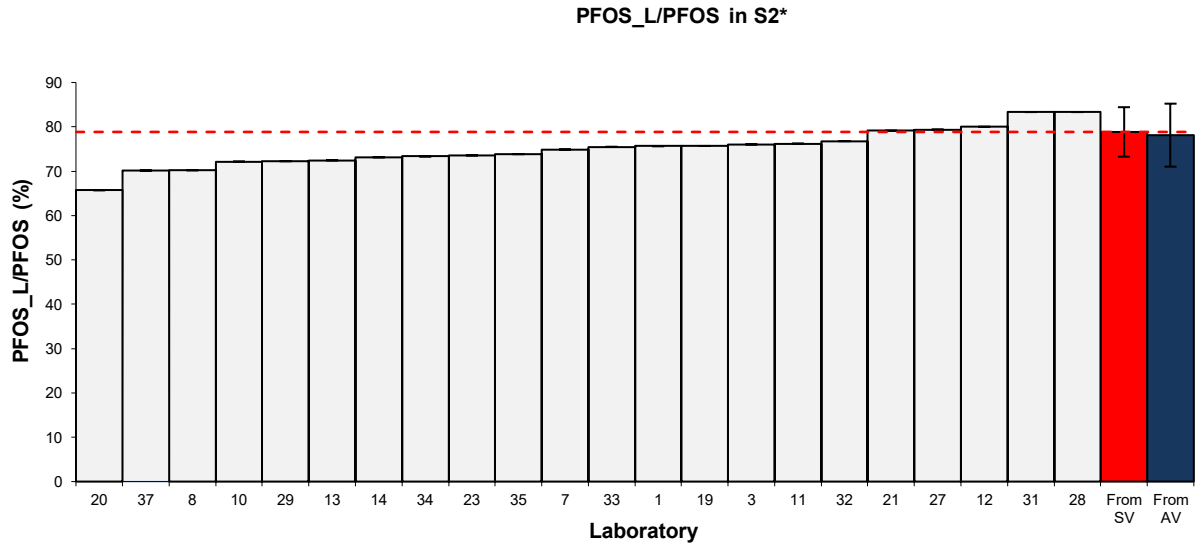



*The ratio from the AV is calculated based on the results reported by all participants including those who reported results for only one analyte.

Figure 97 Bar Charts of PFOS_L/PFOS in S1

The soil sample S2 was spiked with a PFOS standard containing both branched and linear PFOS. The ratio of linear PFOS to total was expected to be 79%, while the ratio calculated from participants results was similar at 78%.

Twenty-two participants reported results for both PFOS total and linear in this sample. The linear to total ratio of the results reported was between 66% and 83% (Figure 98).




*The ratio from the AV is calculated based on the results reported by all participants including those who reported results for only one analyte.

Figure 98 Bar of Charts PFOS_L/PFOS in S2

When a laboratory is using a combined branched/linear standard and integrate branched/linear together for totals, the result could be different to a linear only result due to response factor differences between the isomers.[9]

**PFHpS**, **PFNS** and **PFDS** No assigned value could be set for these analytes in the incurred soil sample S1, because the results reported for these analytes were not compatible.

The PFOS level in Sample S1 was high (11200 µg/kg) which may have resulted in suppression of the PFOS labelled internal standards used for these analytes by some participants.

Laboratories should consider using matrix matched reference materials with high PFOS content to monitor the accuracy of their measurement results for analytes for which labelled PFOS internal standards were used or reassess their evaluations of uncertainty for these tests.

**Long Chain PFSAs** (PFDS, PFUdS, PFDoS and PFTrDS) bind strongly to soil organic matter. As for long chain PFCAs, caution should be exercised when ACN, particularly in the absence of methanol, is used as extraction reagent because has limited ability to disrupt these strong hydrophobic/hydrophilic interactions. Methanol-rich mixtures are required to desorb strongly bound strongly bound PFAS from soil matrices.[10]

**PFUdS** was spiked in Sample S2 at 19.6 ± 1.0 µg/kg. Five participants reported results, and four of these results were in excellent agreement with each other and the spiked value. The methods employed by these participants are presented in Figure 99. The result biased high was from a laboratory who didn't report using a labelled standard as part of their methodology.

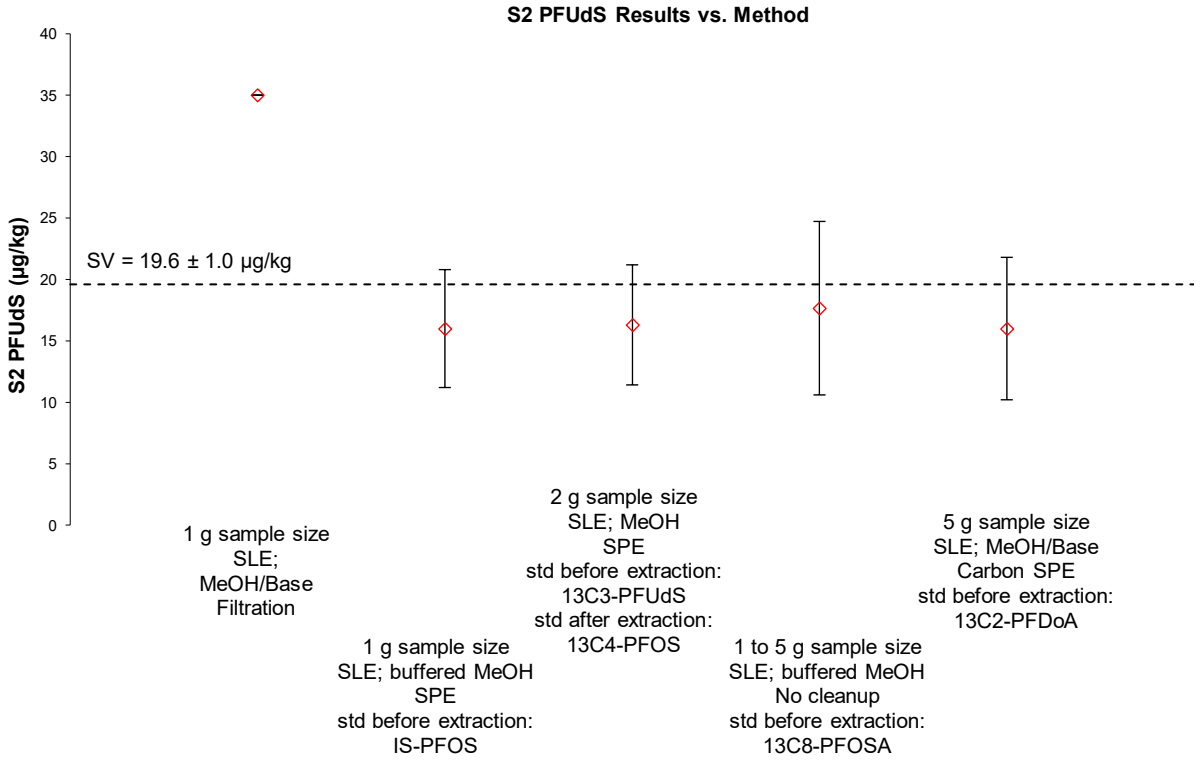



Figure 99 Sample S2 PFUdS Results vs Method

**PFDoS** and **PFTrDS** posed significant challenges for participants' analytical methods. The results reported were not compatible with each other for both PFDoS in the incurred soil sample S1 and PFTrDS in the spiked Sample S2.

Long-chain PFSAs have much higher hydrophobicity than short-chain PFSAs. Consequently, they are strongly retained on reversed-phase LC columns and are prone to peak tailing, broad peaks, or even non-elution without sufficiently long gradients. They are also highly sensitive to small variations in gradient profile, mobile phase composition, and column condition. These factors reduce chromatographic robustness and may contribute to the variability

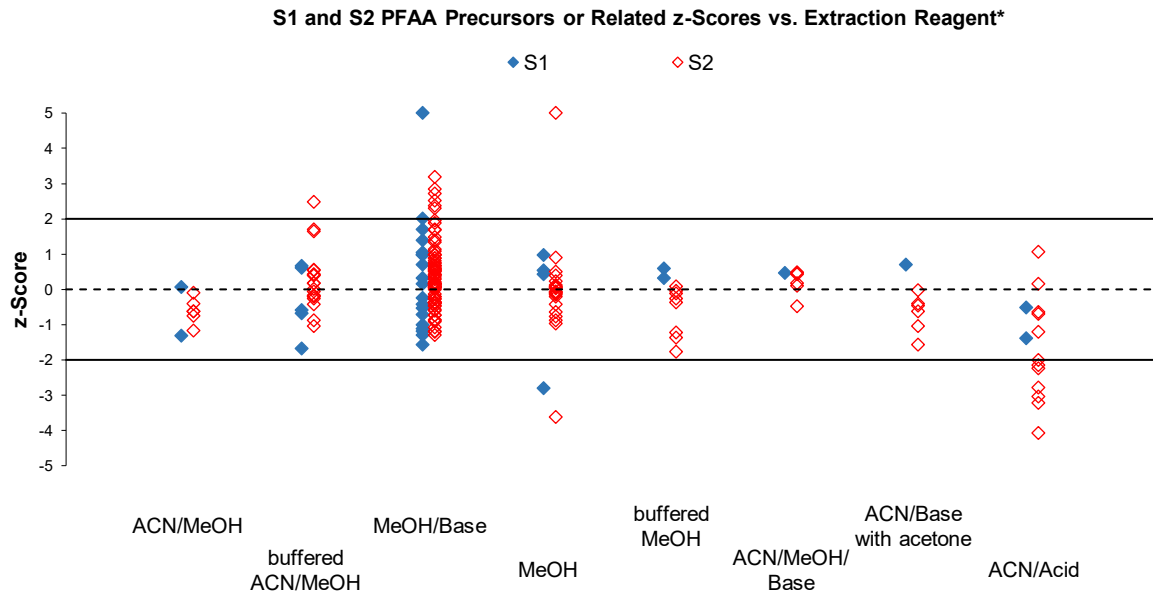
observed between laboratories.[11] Laboratories also should be aware that similar to long chain PFCAs, long chain PFSAs can also be bind to surfaces.[12]

Another major cause for variability of participants results is the limited availability of isotope-labelled internal standards; surrogate standards (such as $^{13}$C-PFOS, $^{13}$C-PFDoA, $^{13}$C-PFTeDA, or $^{13}$C-PFOSA as reported by participants for these analytes) may not reflect the behaviour of C12–C13 PFSAs.[13]

### 6.6.3 Individual PFAA Precursors in Soil

Measurements of most PFAA precursors did not present significant analytical difficulty to participants. The between-laboratory CVs for scored analytes were between 12% and 24%.

PFAAs precursors and related compounds also bind strongly to soil organic matter and mineral surfaces; they remain 'incorporated into soil matter' and difficult to remove. A mild organic extraction with ACN may be insufficient for the extraction of PFAAs from the soil matrix, without strong solvent–matrix disruption like ASE, methanol and optimized conditions (e.g. high temperature).[10] Plots of participants performance for PFAA in Samples S1 and S2 versus the extraction reagent used are presented in Figure 100. Majority of the results from extractions procedures that involved ACN, particularly in the absence of methanol, were biased low.




*Scores greater than 5.0 have been plotted as 5.0

Figure 100 S1 and S2 PFAA Precursors or Related z-Scores vs Extraction Reagent

**6:2FTS** and **10:2FTS** These FTS compounds are now in the analytical suite of majority of participating laboratories. Of 36 participants who reported results for PFAS in Sample S2, 29 reported numeric results for each of the two analytes. The results for each analyte were also in good agreement with each other for both analytes.

The telomer sulfonates are referenced to their $^{13}C_2$ isotope dilution analogue (labelled internal standard added before extraction). The product ions of the telomer sulfonate dilution analogues would contain a small contribution from the $^{34}$S analogue of the native sulfonates if a correction equation is not used, especially with higher native telomer sulfonate concentrations.[12] Laboratory **3** reported using $^{13}C_2$-$D_4$ 10:2 FTS as their labelled standard for 10:2 FTS analysis; the issue is avoided with the use of this labelled standard.

**8:2diPAP** level was low, at 4.90 µg/kg, and this might have challenged participants' analytical techniques. The reported results were variable and on average laboratories recovered only 42% of the spike value (Figure 101). The result reported by Laboratory **21** of 5 µg/kg was in relatively good agreement with the spiked value.

**3:3FTCA** This is the second time the analyte has been introduced in a PT study. Fourteen laboratories reported results and most were compatible with each other (Figure 102). However, results were generally biased low as compared to the spiked value. The robust average was only 47% of the spike value. While there is a labelled 3:3FTCA standard available, all participants used isotopically labelled analogues of different compounds instead, which may have contributed to the bias of participants' results.

**6:2FTOH** This is the first time that 6:2FTOH has been tested for in a soil sample in NMIA's PFAS PT program. This volatile analyte presented significant analytical challenges, with only two participants reporting numeric results (Laboratories **20** and **29**). While the two results agreed with each other, they were only 21% and 28% of the spiked value.

Although LC methods for their analysis do exist, GC based methods are generally recommended.[14,15]

There were no specific questions in the results sheet pertained to this analyte, so the methodology reported by participants may not be the one used for this analyte. The questionnaire will be updated for our next study to address this. However, Laboratory **29** reported the following method for their FTOH analysis: solid-liquid extraction using MTBE, 120 minutes extraction time, no extract concentration, and analysis using GC-NCI-MS.

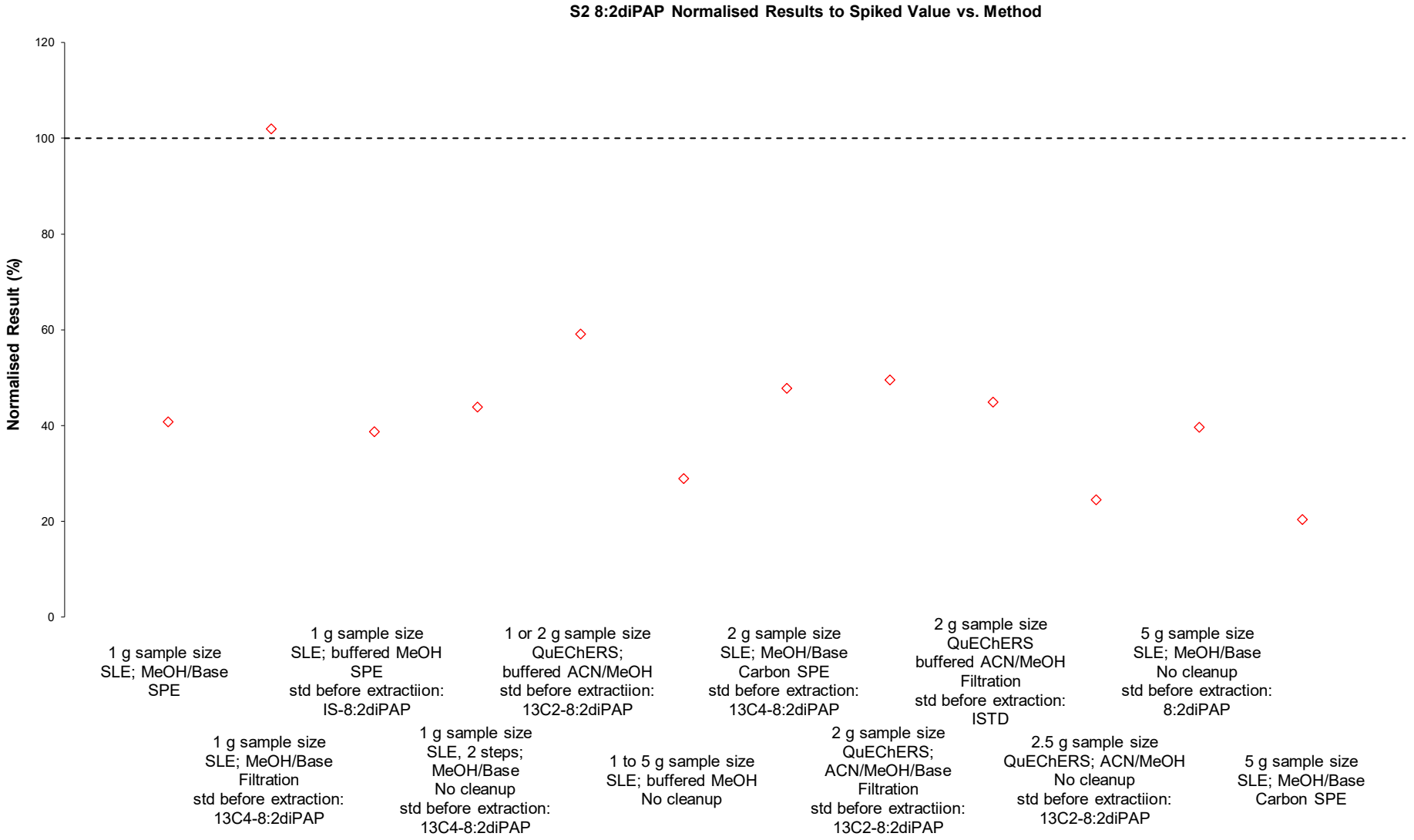



Figure 101 S2 8:2diPAP Normalised Results to Spike Value vs Method

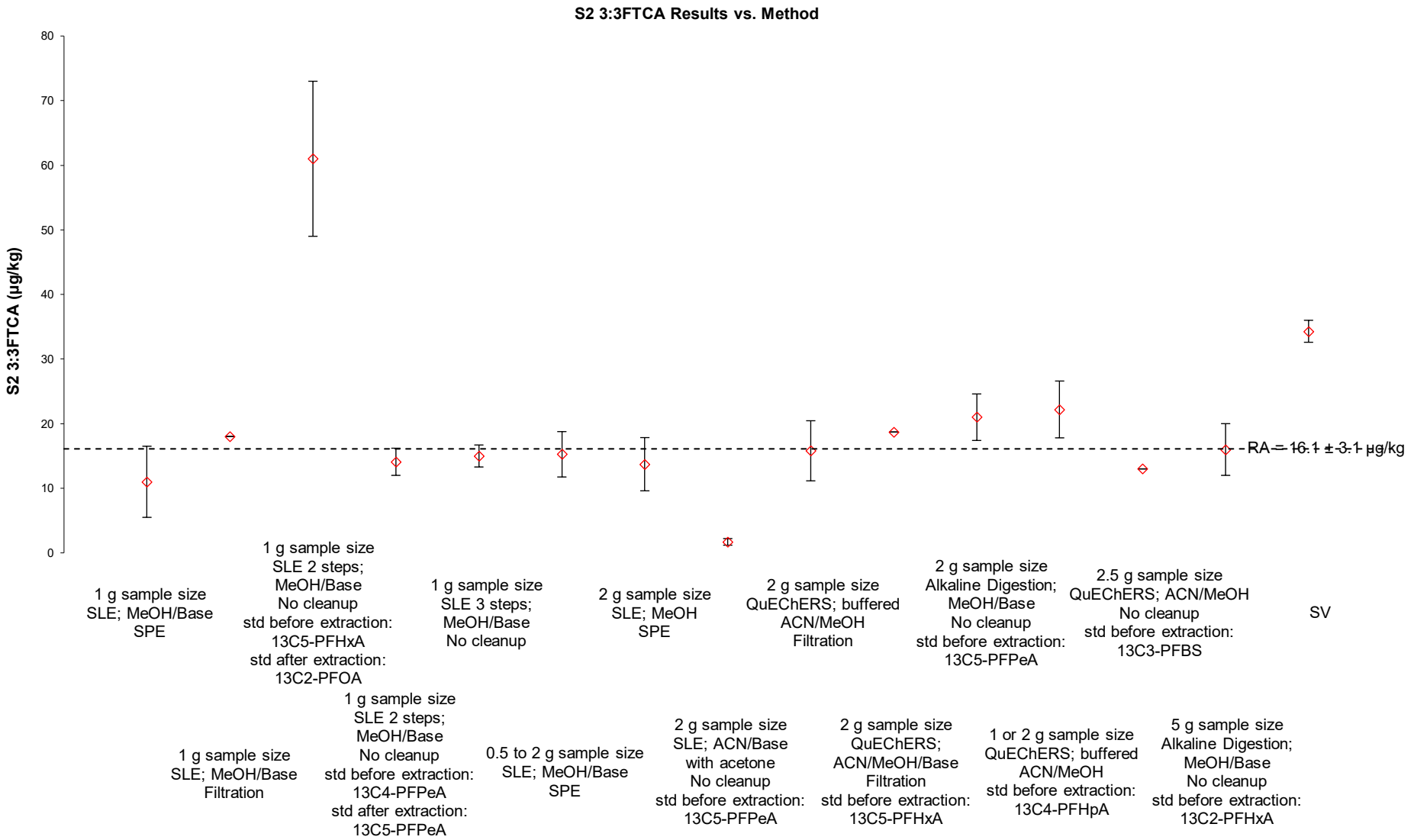



Figure 102 S2 3:3FTCA Results vs Method

### 6.6.4 Individual PFECA and PFESA Analytes in Soil

There were no PFECA or PFESA analytes present in the soil sample S1.

Measurement of the PFECA and PFESA analytes in fortified soil sample S2 did not present a challenge to participants' analytical techniques; the between-laboratory CVs varied from 15% to 23%.

**PFMPA** This is the second study where this analyte has been assessed, and the first study where it has been spiked rather than incurred. The number of participants reporting numeric results has doubled since last year to a total of 12. Participants results were compatible with each other with all results returned acceptable *z*-scores (Figure 103); results were also in good agreement with the spiked value.

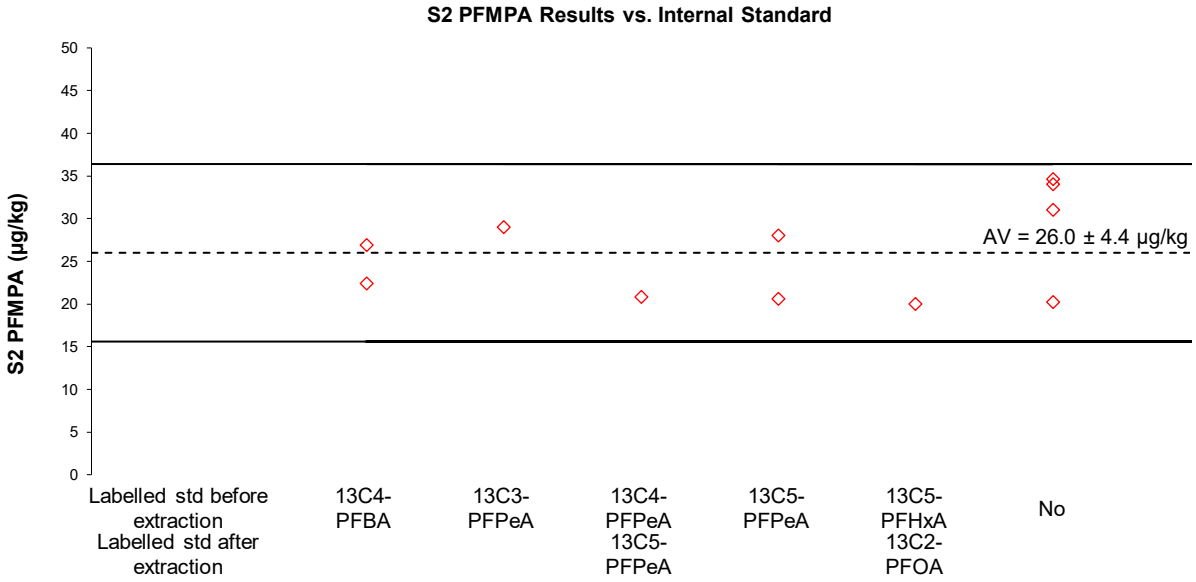



Figure 103 S2 PFMPA Results vs Internal Standard

**11Cl-PF3OUdS** was spiked into soil Sample S2 at a low level of 4.92 µg/kg, much lower than in previous studies, and this may have challenged participants' analytical methods. Overall participating laboratories recovered only 46% of the spiked amount (lower than for previous studies), and no assigned value was set for this test. Without labelled 11Cl-PF3OUdS standards being commercially available, recovery of this analyte from the matrix might not be accurately reflected, which may have also contributed to the poor recovery of the spike value.

**PFEESA** This is the second study where this analyte has been assessed. Although PFEESA was spiked in Sample S2 at a lower level, participants performed acceptably. The labelled internal standards used by participants before and after extraction are presented in Figure 104.

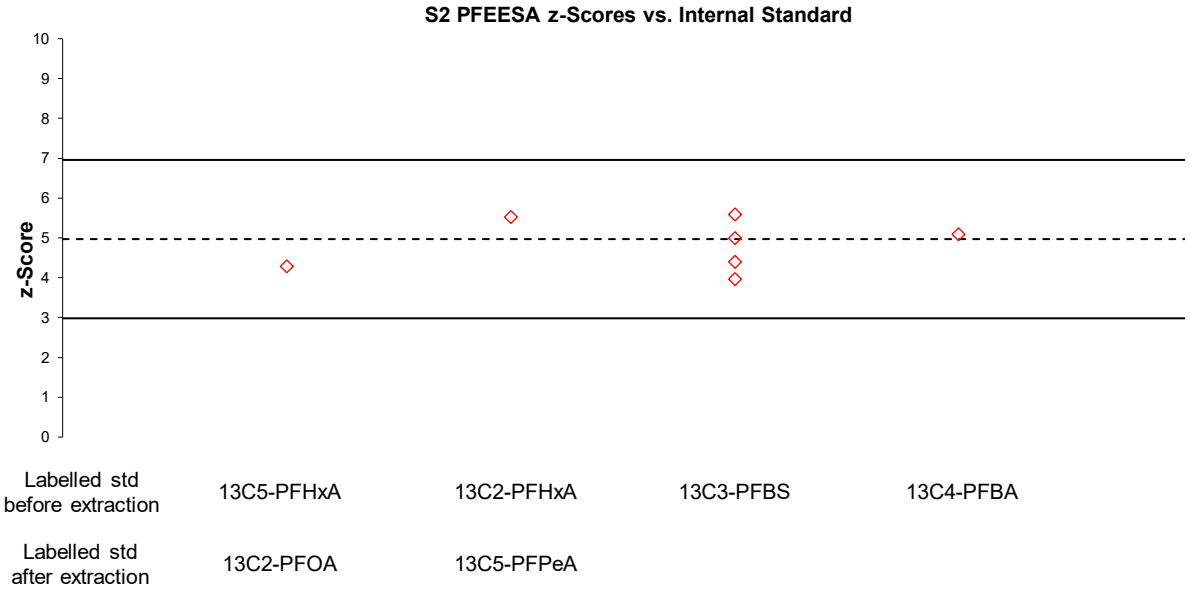



Figure 104 S2 PFEESA z-Scores vs Method

## 6.7 Participants' Results and Analytical Methods for PFAS in Biosolids

This is the third time that a biosolids sample has been included in a NMIA PT study for PFAS, and the second time that participants' performance in measurement PFAS in biosolids matrix has been assessed. The method descriptions provided by participants for PFAS measurements in biosolids are presented in Appendix 6.

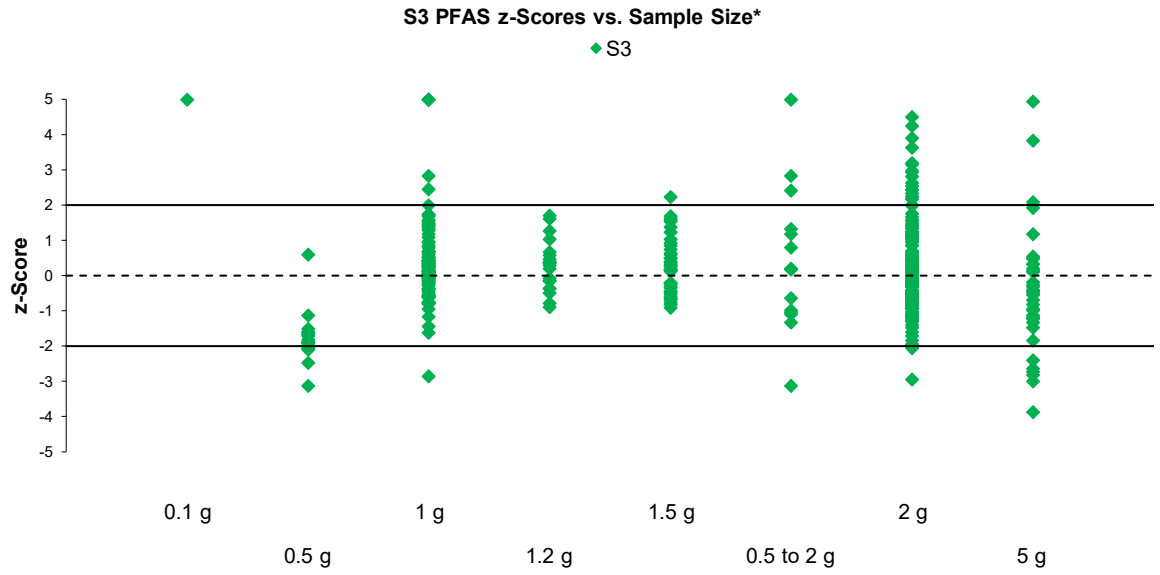
In the present study, 24 participants reported results for PFAS in biosolids. Overall, the between-laboratory CVs of the biosolids Sample S3 were higher than those of the spiked soil sample S2 and similar to those of the incurred soil S1, ranging between 8.5% and 72%.

As in the previous study, the sample was moist and participants were asked to report results on as received basis (not corrected for moisture content).

Most participants who analysed both the soil and biosolids samples reported using the same, or similar, analytical methods. The most frequent changes seen in the methods used for biosolids when compared to methods used for soil were sample size (both increased and decreased) and adding a carbon clean-up step for the biosolids analysis.

### Extraction

Laboratories used a variety of sample sizes ranging from 0.1 g to 5 g. Plots of participants' performance in Sample S3 versus the amount of sample taken for analysis are presented in Figure 105. Caution should be exercised when a small sample size is taken for analysis as this might not be representative of the whole sample. Homogeneity of these PT samples may not reflect the homogeneity of routine samples encountered by laboratories.

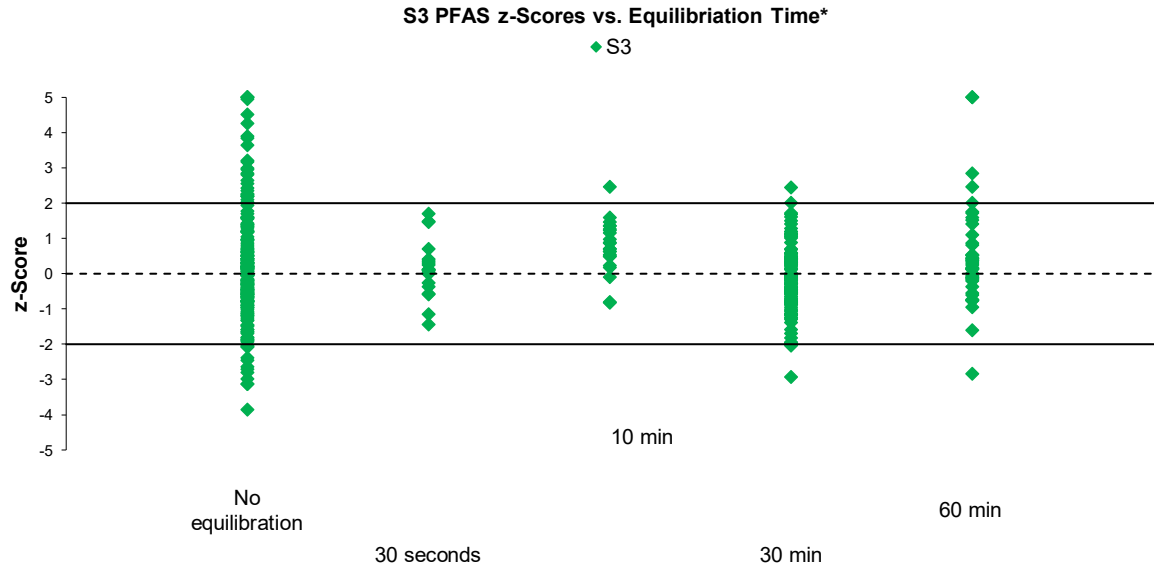



*Scores greater than 5.0 have been plotted as 5.0

Figure 105 S3 PFAS z-Scores vs Sample Size

All participants added isotopically labelled internal standards before extraction, and 10 of them left the sample to equilibrate. Plots of participants' z-scores versus equilibration time are presented in Figure 106. No significant differences were evident between the performance of those participants who left the sample to equilibrate and those who didn't.

Laboratories **7**, **21**, and **23** did not correct the results for the internal standard recovery. The results reported by these laboratories were biased high, with the exception of those reported by Laboratory 7 (Figure 81).




*Scores greater than 5.0 have been plotted as 5.0

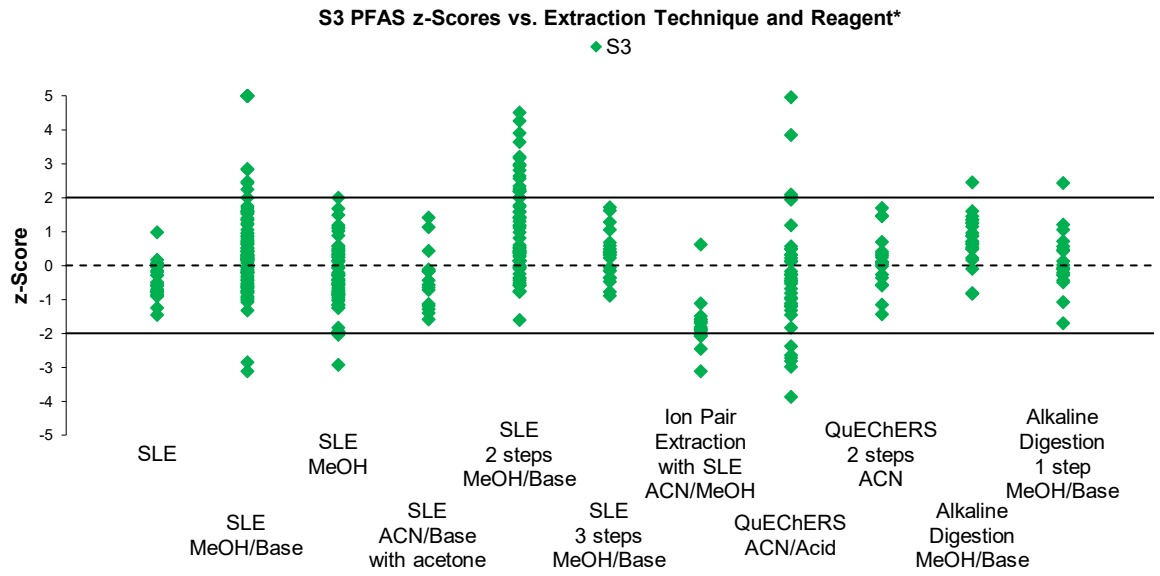
Figure 106 S3 PFAS z-Scores vs Equilibration Time

Most participants used the same extraction technique and reagent for biosolids as for soil, with the preferred extraction reagents for biosolids also being methanol and base modified methanol (Figure 107). As with soil, caution should be exercised when ACN is used as extraction solvent as it has limited ability to desorb long chain PFAS (C8+), including PFAA, from biosolids.[10]

Three participants reported minor modifications in extraction for biosolids as compared to soil, e.g. using additional extraction steps, or adding base to their extraction reagent.

Two participants changed their extraction technique (one used ion pair extraction with SLE for soil and QuEChERS for biosolids, while another used QuEChERS for soil and ion pair extraction with SLE for biosolids).

Five participants reported using a staggered extraction: three conducted SLE over 2 steps, one used a staggered SLE over 3 steps, and one used QuEChERS over 2 steps (Figure 107).

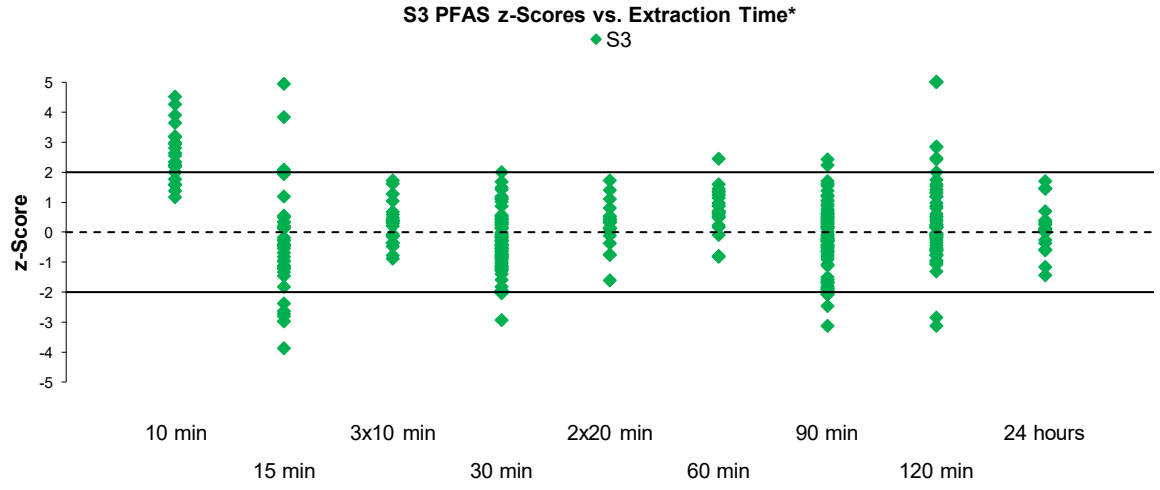



*Scores greater than 5.0 have been plotted as 5.0

Figure 107 S3 PFAS z-Scores vs Extraction Technique and Reagent

Fifteen participants added loose carbon to the biosolids sample extract to facilitate better adsorption of interferent organics.[9]

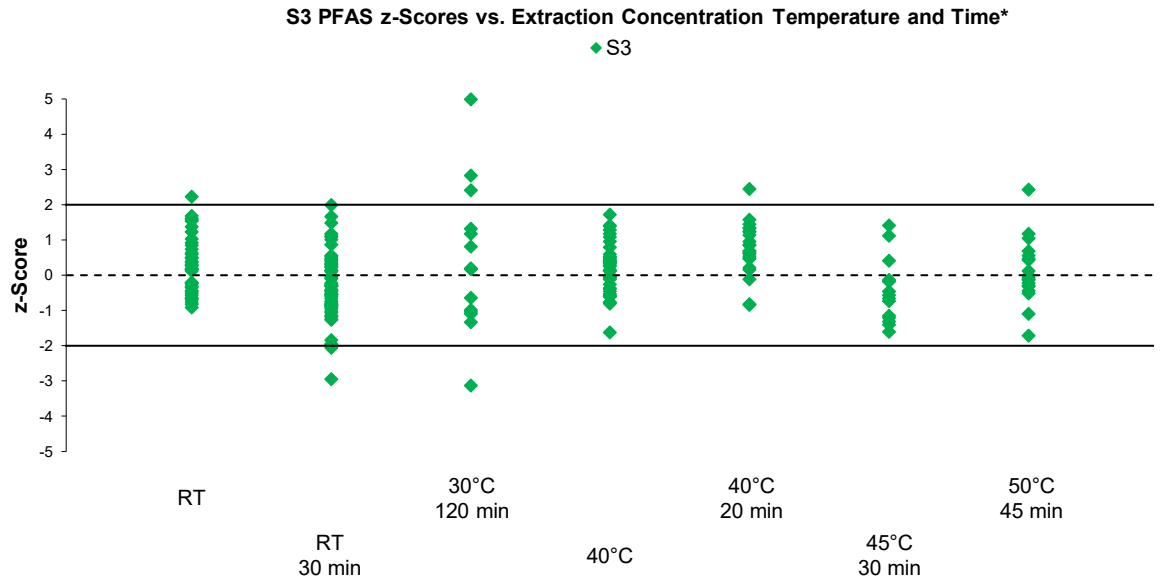
The extraction time used by participants varied from 10 minutes to 24 hours (Figure 108). As with soil, one participant extracted for 10 minutes and returned results that were biased high, however no similar pattern was observed in the previous NMIA PFAS in biosolids study and so this could potentially be attributed to other methodology parameters employed by this participant.




*Scores greater than 5.0 have been plotted as 5.0

Figure 108 S3 PFAS z-Scores vs Extraction Time

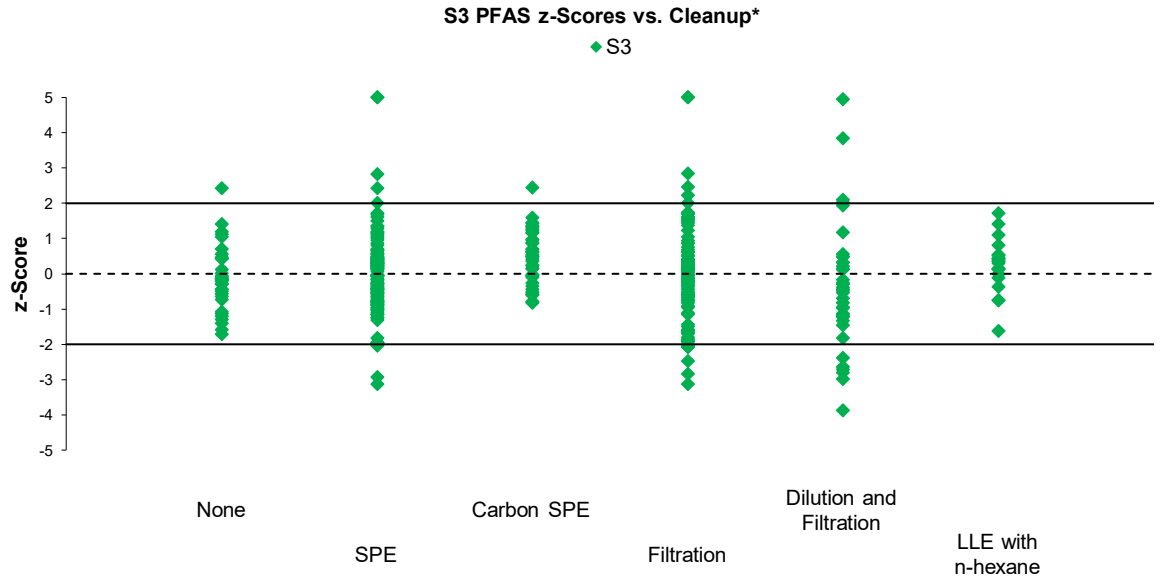
Six participants concentrated their sample extract at a temperature of 30°C to 50°C (Figure 109).




*Scores greater than 5.0 have been plotted as 5.0

Figure 109 S3 PFAS z-Scores vs Extract Concentration Temperature and Time

Many participants performed a clean-up step, with most using SPE or filtration (Figure 110).




*Scores greater than 5.0 have been plotted as 5.0

Figure 110 S3 PFAS z-Scores vs Cleanup Procedure

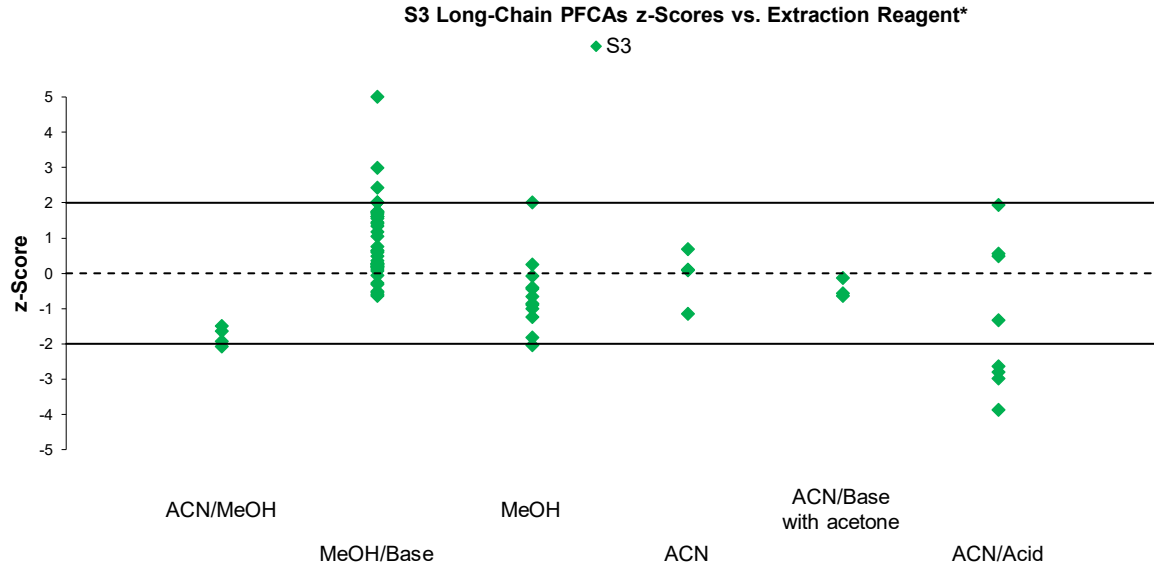
### Instrumental Technique

As for soil, only Laboratories **6**, **22**, and **28** used LC-Orbitrap; all other participants used LC-MS/MS. There was no significant difference between the participants' results obtained using the two instrumental techniques.

### 6.7.1 Individual PFCA Analytes in Biosolids

The between-laboratory coefficient of variation for PFCAs in Sample S3 was between 12% and 42%.

**Long Chain PFCAs** Participants' performance for the long-chain PFCA analytes (PFNA, PFDA, PFTrDA and PFTeDA) by extraction reagent is presented in Figure 111. There may be a relationship between low biased results and the use of ACN as the extraction reagent. PFCAs (>C8) bind strongly to biosolids. Caution should be exercised when using ACN as the extraction reagent, as it is less effective at breaking the strong hydrophobic and hydrophilic interactions these analytes form with biosolids. Methanol-rich solvent mixtures are generally needed to effectively desorb strongly bound PFAS from biosolids matrices.[10]




*Scores greater than 5.0 have been plotted as 5.0

Figure 111 S3 Long-Chain PFCAs z-Scores vs Extraction Reagent

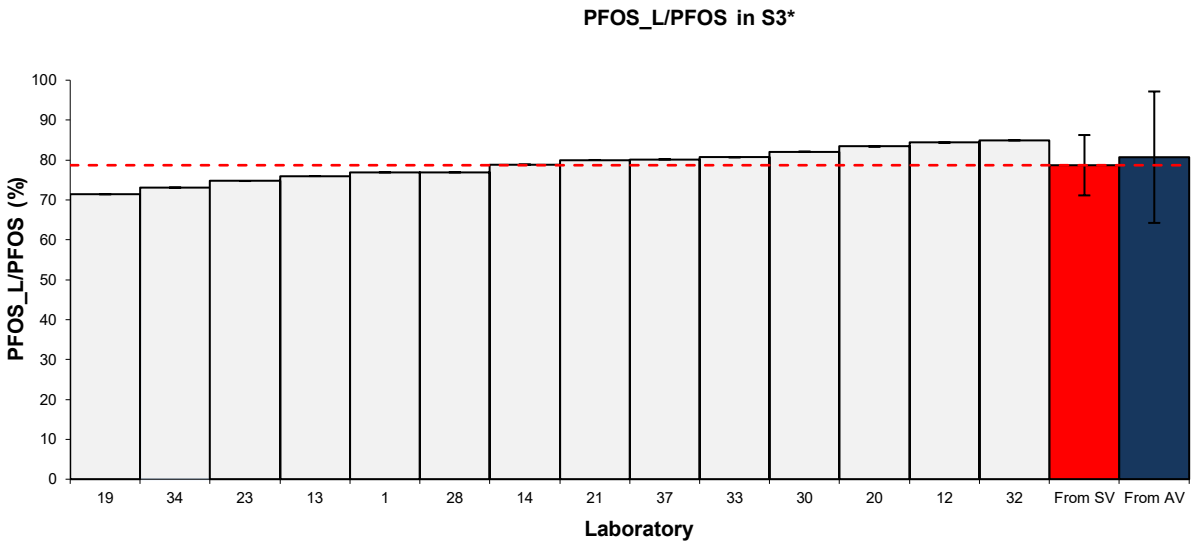
**PFDoA** was present in the sample at a low level, around 0.80 µg/kg, and below the reporting limits of some laboratories, which may have challenged participants' analytical techniques. The reported results were highly variable, and no assigned value could be established for this test.

### 6.7.2 Individual PFSA Analytes in Biosolids

The between-laboratory coefficient of variation for PFSAs in Sample S3 was between 8.5% and 29%, except for PFDoS which was 53%. In general, participants were more challenged by longer-chain PFSAs as compared to shorter-chain PFSAs, similar to what was observed for the soil samples.

**PFOS**, and **PFOS_L** Sample S3 was prepared to have a linear PFOS to total PFOS ratio of 79%, which is similar to the expected ratio from the assigned values of 81%. Participants were asked to report for PFOS both the total (the sum of linear and branched isomers) and linear (the linear isomers only) results.

Fourteen participants reported results for both total and linear PFOS in Sample S3. The linear to total ratio of the result reported was between 71% to 85% (Figure 112).




*The ratio from the AV is calculated based on the results reported by all participants including those who reported results for only one analyte.

Figure 112 Bar Charts of PFOS_L/PFOS in S3

**Long Chain PFSAs** Measurements of long chain PFSAs (PFNS, PFDS, PFDoS) in biosolids Sample S3 challenged participants' analytical techniques. The results were variable, with a robust between-laboratory CVs ranging from 29% to 53%.

As for soil the variability in results may arise from the challenging chromatographic behaviour of long-chain PFSAs, which show strong retention and sensitivity to slight changes in LC conditions, from surface adsorption effects similar to those observed with long-chain PFCA, and from the limited availability of appropriate isotope-labelled internal standards, as surrogate standards do not adequately correct for C12 PFSAs.[11-13]

**PFDoS** This analyte in particular challenged participants in biosolids. No assigned value could be established because the reported results were too few and too variable. Plots of participants results versus the labelled internal standard used before and after extraction are presented in Figure 113.

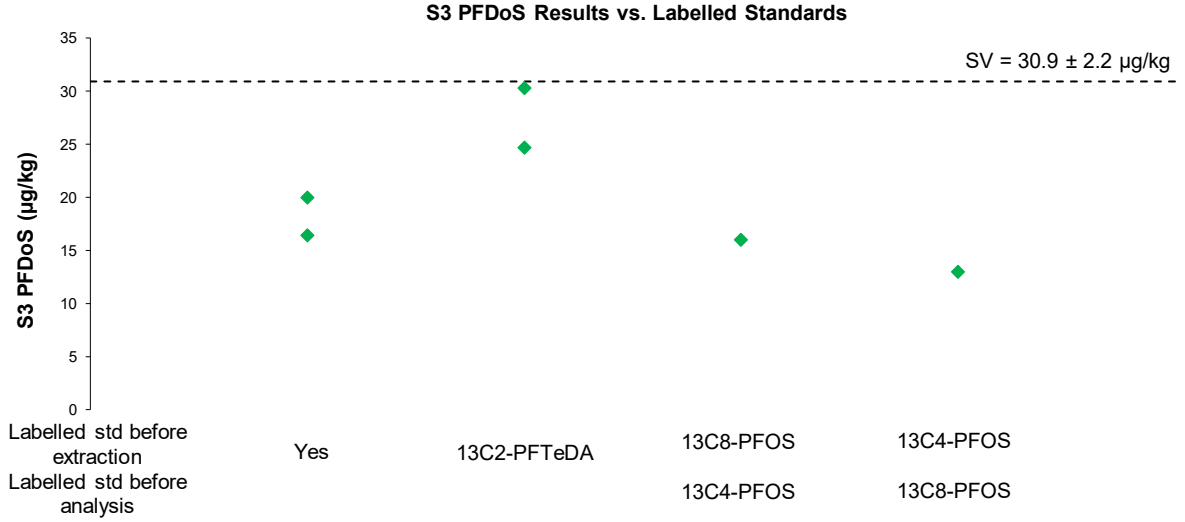



Figure 113 S3 PFDoS Results vs Labelled Standards

### 6.7.3 Individual PFAA Precursors in Biosolids

**PFOSA**, **EtFOSAA,** and **6:2FTS** did not present significant analytical challenges for participants, with results being in good agreement with each other and the spiked values.

**6:2diPAP** and **8:2diPAP** This study included 6:2diPAP in biosolids for the first time, while 8:2diPAP had been assessed twice previously. As in earlier studies, no assigned value could be established for either analyte. However, a greater number of participants reported numeric results compared to past rounds, indicating that laboratories are expanding the range of diPAPs they are now measure.

Participants' results for 6:2diPAP and 8:2diPAP versus methodology are presented in Figure 114 and Figure 115 respectively.

**5:3FTCA** has been introduced for the second time in biosolids. Although more participants reported results for this analyte compared with the previous study, the results were still not compatible with each other.

Participants' results by method used are presented in Figure 116. Participants using MeOH/Base as their extraction reagent generally reported higher results than those using other extraction reagents.

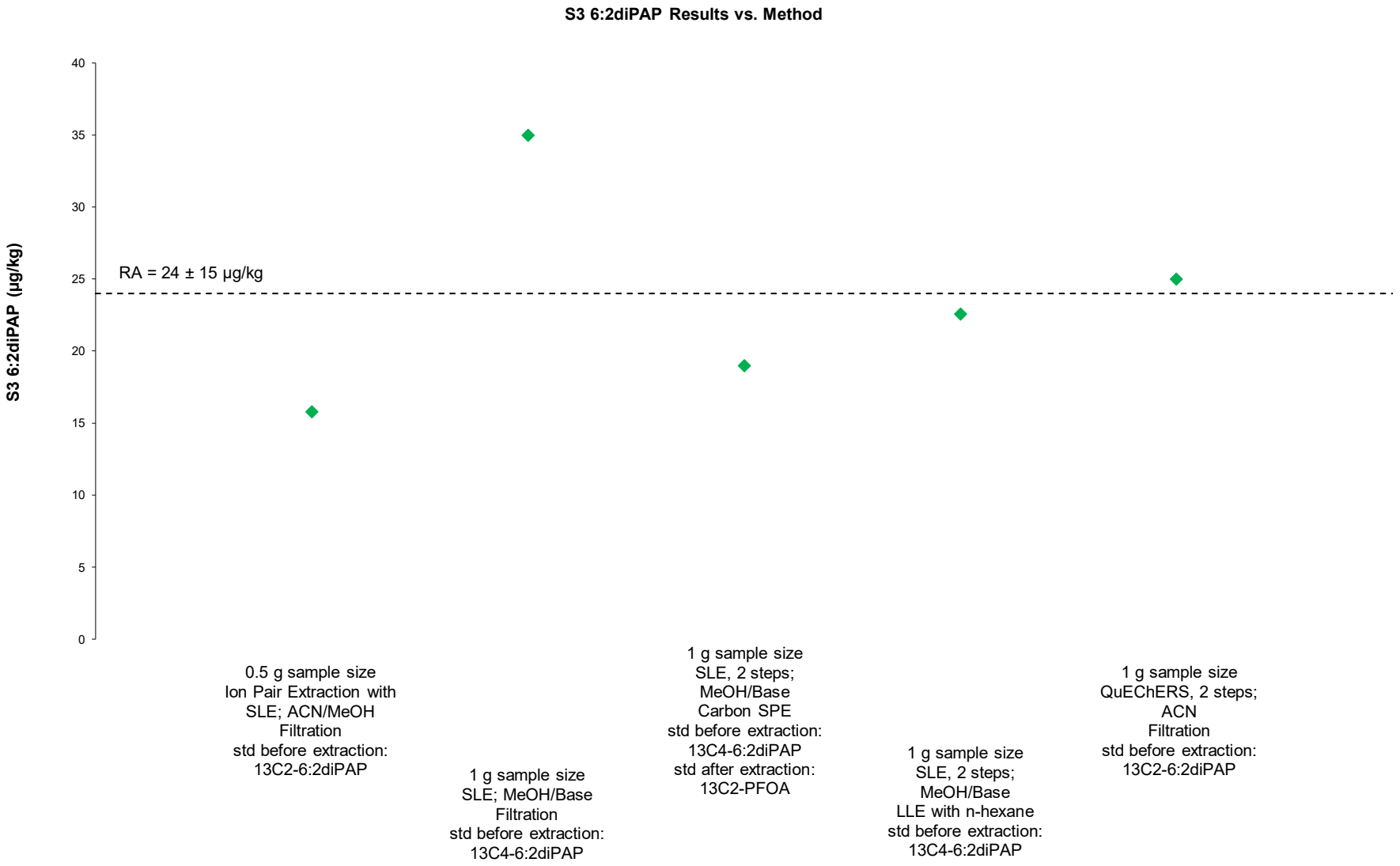



Figure 114 S3 6:2diPAP Results vs Method

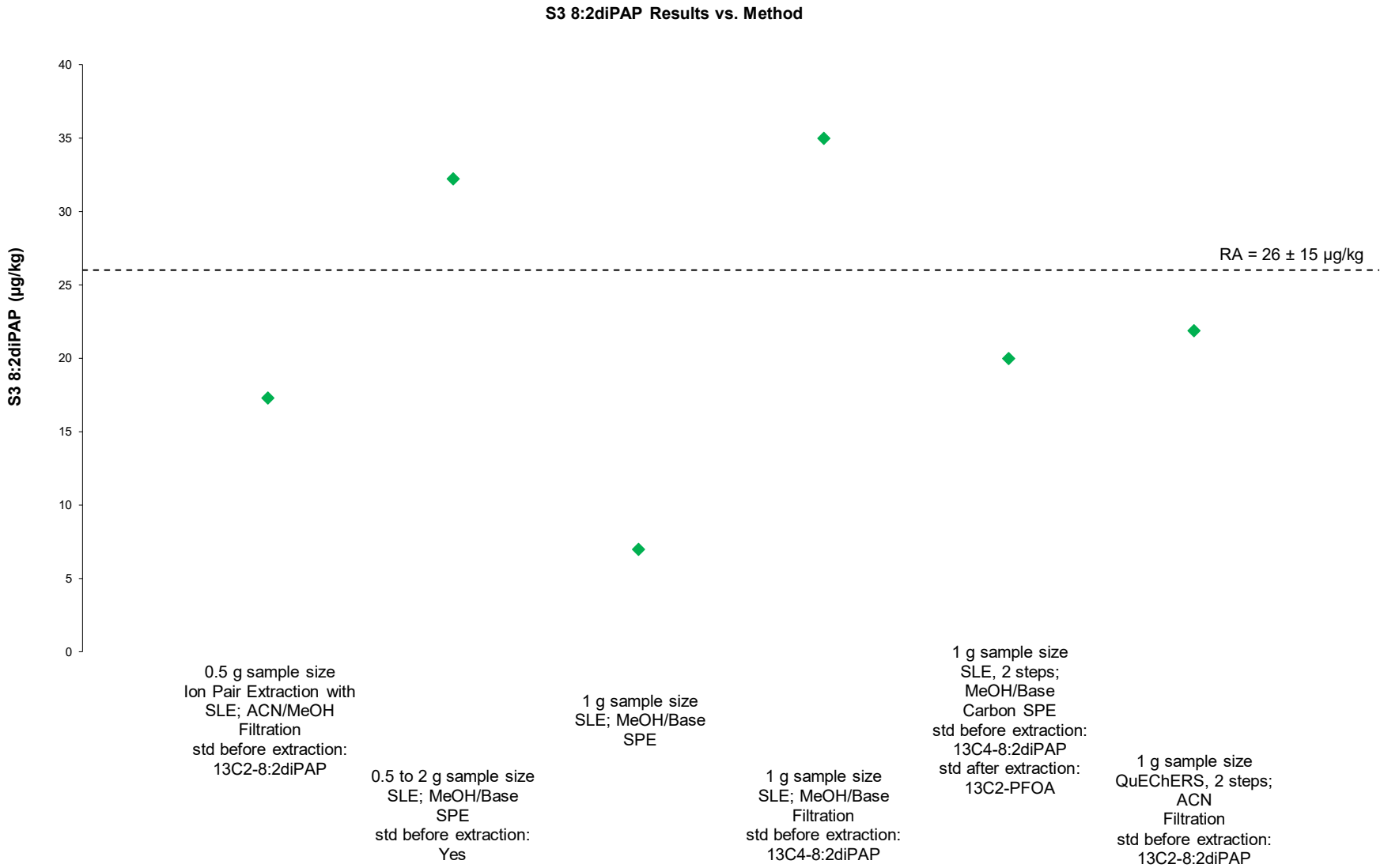



Figure 115 S3 8:2diPAP Results vs Method

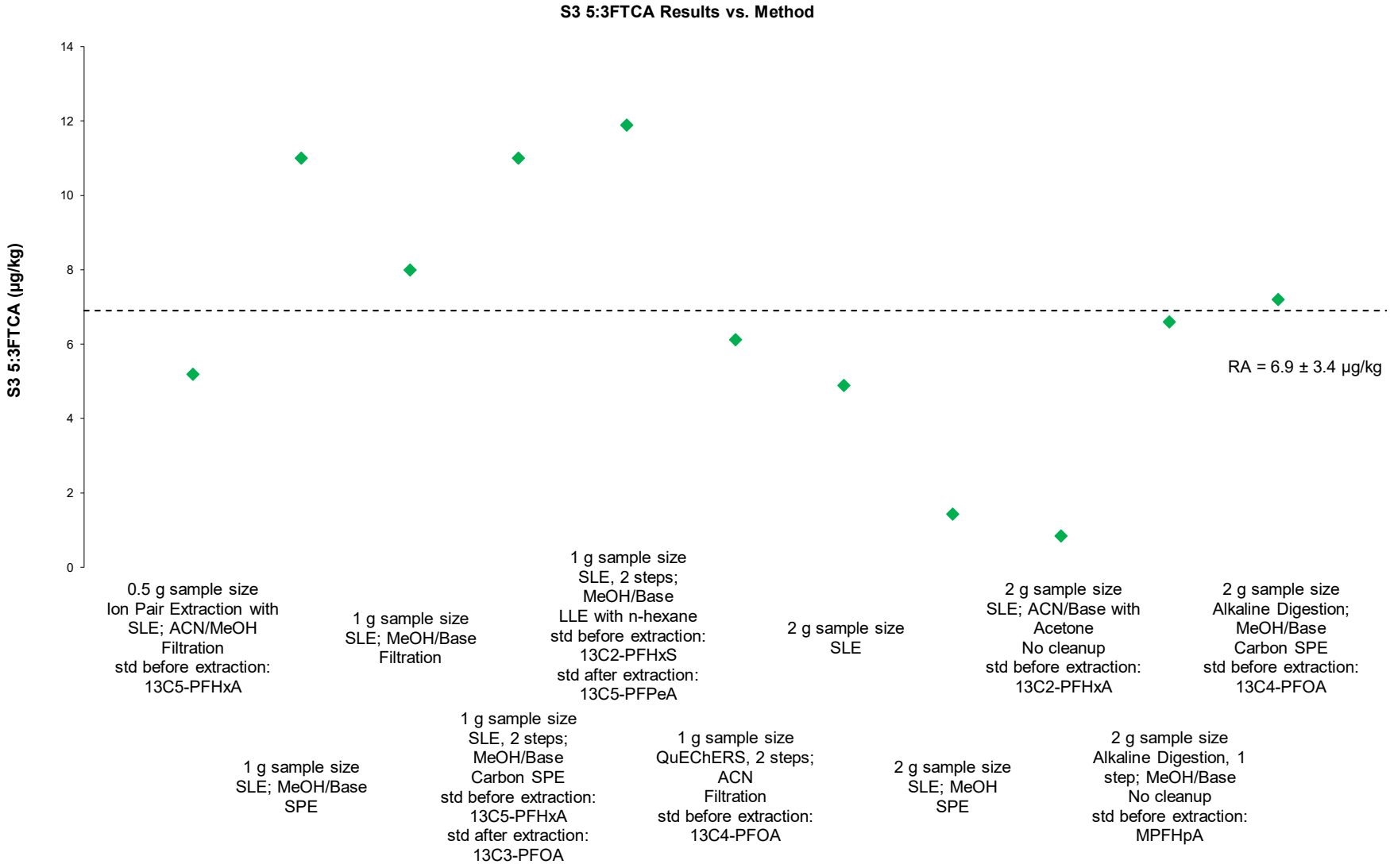



Figure 116 S3 5:3FTCA Results vs Method

### 6.7.4 Individual PFECA and PFESA Analytes in Biosolids

Overall, participants showed improved capability in measuring PFECA and PFESA analytes in biosolids. The results reported for these analytes were generally compatible with each other and with the spiked value, regardless of the methodology used.

## 6.8 False Negatives

Appendix 5 presents false negative results. These are analytes present in the samples which a participant tested for but did not report a numeric result; for example, participants reporting a 'less than' result (< *x*) when the assigned value was higher than their limit of reporting (LOR), or participants that did not report anything. For analytes where no assigned value was set, results have only been considered to be false negatives where the consensus value and spike value (if applicable) were significantly higher than the participants' LOR (i.e. the consensus value minus the expanded uncertainty, and the spike value minus the expanded uncertainty, were both greater than the LOR), or if no value was reported.

## 6.9 Effects of Sample Matrix

Measurements of PFAS analytes in the biosolids sample S3 challenged more participants' analytical techniques than in the incurred and spiked soils (Table 88).

Table 88 Acceptable z-Scores for Each Matrix

| Sample | Matrix | Expected Number of Results | Numeric Results Reported | *z*-Scores Calculated | Acceptable *z*-Scores |
|---|---|---|---|---|---|
| S1 | Incurred Soil | 640 | 455 (71%) | 359 | 320 (89%) |
| S2 | Spiked Soil | 1050 | 653 (62%) | 587 | 539 (92%) |
| S3 | Spiked Biosolids | 728 | 513 (70%) | 465 | 373 (80%) |

## 6.10 Comparison with Previous PFAS in Soil and Water

In the first study conducted by NMIA for PFAS analytes in soil AQA 15-03, participants were asked to report results for PFOA and for total and linear PFOS. Eleven laboratories enrolled in this study of which 10 reported results. The lack of mass-labelled linear and branched standards was the main problem encountered by participants at that time. Since then, a large number of standards and labelled standards have become available and so more analytes have been added each year to follow-up PT studies. Laboratories have developed methods for the analysis of a wide spectrum of PFAS contaminants and in general the reported results are compatible, showing that the mass-labelled standards are capable of correcting for the differences between these methods. A summary of the rates of participation and reported results in NMIA proficiency tests of PFAS in soil over the last 10 studies (2016 to 2025) is presented in Figure 117.

AQA 25-10 is the eleventh NMIA proficiency test of PFAS analytes in soil, and the second assessed PT study for PFAS in biosolids. For all analytes, the same set standard deviation for proficiency assessment was used in the present study as in previous studies. This allows for a comparison of participants' performance over time and provides a benchmark for progressive improvement.

Participants continue to have difficulties measuring PFNS and PFDS in soil samples with high PFOS content. As in previous studies, no assigned value was set for these analytes in the incurred soil sample because the reported results were too variable.

A summary of participants' performance in the measurement of PFAS analytes in soil over time is presented in Figure 118.

Over time, laboratories should expect at least 95% of their scores to lay within the range $|z| \leq 2.0$. Scores in the range $2.0 < |z| < 3.0$ can occasionally occur, however these should be interpreted in conjunction with the other scores obtained by that laboratory. For example, a trend of *z*-scores on one side of the zero line is an indication of method or laboratory bias. Individual performance history reports are emailed to each participant at the end of the study; the consideration of *z*-scores for an analyte over time provides much more useful information than a single *z*-score.

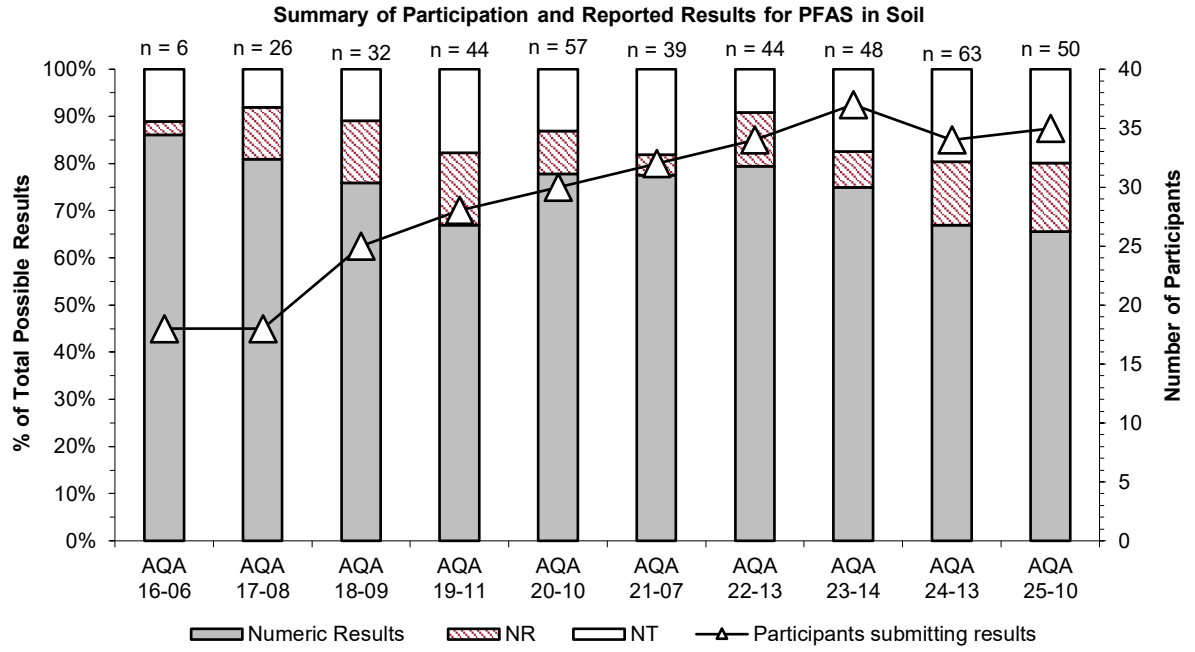



Figure 117 Summary of Participation and Reported Results for PFAS in Soil PT Studies (n = number of analytes).

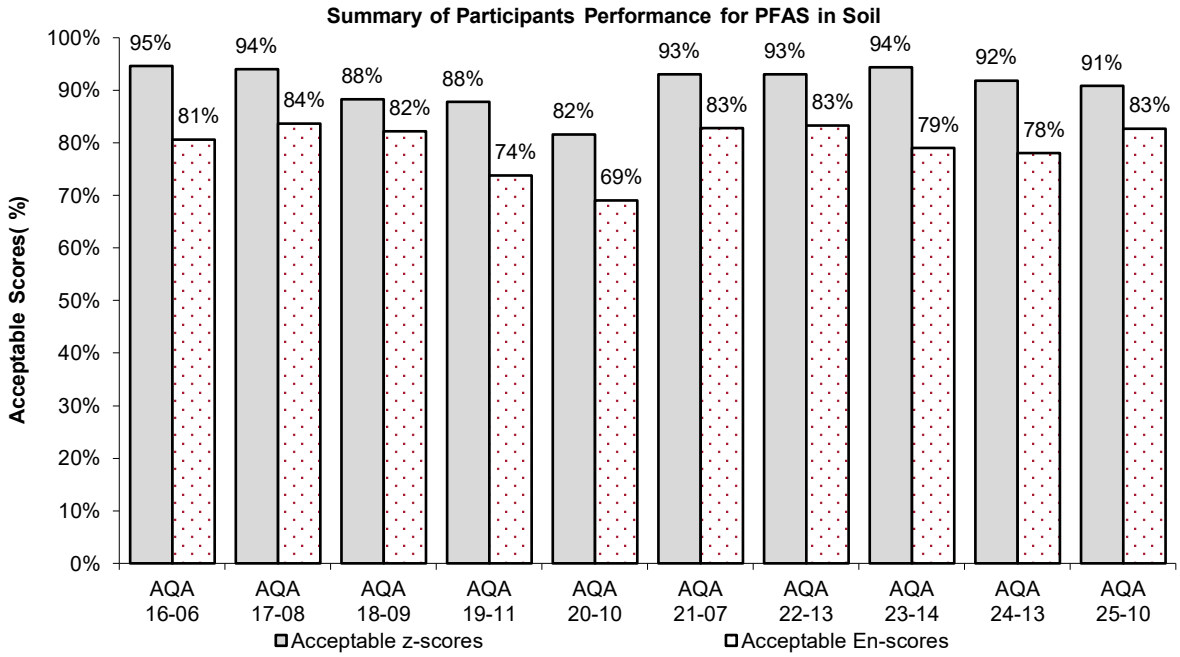



Figure 118 Summary of Participants' Performance for PFAS in Soil PT Studies

## 7 REFERENCES

Note: For all undated references, the latest edition of the referenced document (including any amendments) applies.


[1] ISO/IEC 17043, *Conformity assessment – General requirements for the competence of proficiency testing providers*.

[2] Commonwealth of Australia, Department of Industry, Science and Resources, NMIA, Study Protocol for Proficiency Testing, 2025, viewed January 2026, <https://www.industry.gov.au/sites/default/files/2020-10/cpt_study_protocol.pdf>.

[3] Commonwealth of Australia, Department of Industry, Science and Resources, NMIA, Chemical Proficiency Testing Statistical Manual, 2025, viewed January 2026, <https://www.industry.gov.au/sites/default/files/2019-07/cpt_statistical_manual.pdf>.

[4] Thompson, M., Ellison, S.L.R. & Wood, R. 2006, 'The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories', *Pure Appl. Chem.,* vol. 78, pp. 145-196.

[5] ISO 13528, *Statistical methods for use in proficiency testing by interlaboratory comparison*.

[6] Thompson, M., 2000, 'Recent trends in inter-laboratory precision at ppb and sub-ppb concentrations in relation to fitness for purpose criteria in proficiency testing', *Analyst*, vol. 125, pp. 385-386.

[7] ISO/IEC 17025, *General requirements for the competence of testing and calibration laboratories.*

[8] Eurachem/CITAC Guide, Quantifying Uncertainty in Analytical Measurement, 3rd ed., viewed January 2026, <http://www.eurachem.org/images/stories/Guides/pdf/QUAM2012_P1.pdf>.

[9] USEPA Office of Water, 2024, 'Method 1633 Revision A, Analysis of Per- and Polyfluoroalkyl Substances (PFAS) in Aqueous, Solid, Biosolids, and Tissue Samples by LC-MS/MS'.

[10] MacLennan, M. S., Ng, D. & Hope, D., 2021, 'Extraction and analysis of poly- and perfluoroalkyl substances (PFAS) from soil', viewed January 2026, <https://documents.thermofisher.com/TFS-Assets/CMD/Application-Notes/can-73937-lc-ms-poly-extraction-pfas-soil-can73937-en.pdf>

[11] McHale C., 2025, 'Current LC/MS approaches for PFAS analysis with ultrashort and long chain mixtures soil', viewed January 2026, <https://halocolumns.com/wp-content/uploads/2025/03/AMT_TR_02_2025_PFAS_final.pdf>

[12] USEPA Office of Water, 2019, 'Method 533: Determination of per- andolyfluoroalkyl substances in drinking water by isotope dilution anion exchange solid phase extraction and liquid chromatography/tandem mass spectrometry'.

[13] Genualdi, S. & deJager, L., 2024, FDA Foods Program Compendium of Analytical Laboratory Methods: Chemical Analytical Manual (CAM), 'Determination of 30 Per and Polyfluoroalkyl Substances (PFAS) in Food and Feed using Liquid Chromatography-Tandem Mass Spectrometry (LC-MS/MS)'.

[14] Advanced Standards Transforming Markets (ASTM) International, 2025, ASTM D8591-25, 'Standard Test Method for Determination of Fluorotelomer Alcohols in Test

Chamber Air by Thermal Desorption-Gas Chromatography-Triple Quadrupole Tandem Mass Spectrometry (TD-GC-MS/MS)'.

[15] Lee J.X., Lee, S.A., Lim, T.Y.A., Liw, W.T., Xing, J. & Zhan, Z., 2019, Shimadzu Application News No AD-0201, 'Analysis of Perfluorooctane Sulfonamidoethanols (FOSEs) and Fluorotelomer Alcohols (FTOHs) in Textiles by LC/MS/MS'.

[16] Bertil, M., Näykki, T., Hovind, H., Krysell, M. & Sahlin, E., 2017, Nordtest Report Handbook for Calculation of Measurement Uncertainty in Environmental Laboratories TR 537, 4th ed.

## APPENDIX 1 – SAMPLE PREPARATION

**Sample S1**: 1700 g of contaminated soil was ground, sieved, mixed and then divided into equal portions of approximately 20 g each.

**Sample S2:** 2000 g of dried and sieved soil fortified for 30 PFAS analytes, mixed and divided into portions of approximately 20 g each.

**Sample S3:** 2600 g of moist biosolids was autoclaved and fortified for 25 PFAS analytes. The moist fortified biosolids was then divided into portions of approximately 20 g each.

## APPENDIX 2 – ROBUST AVERAGE AND ASSOCIATED UNCERTAINTY, z-SCORE AND $E_N$-SCORE CALCULATIONS

### A2.1 Robust Average and Associated Uncertainty

The robust average was calculated using the procedure described in ISO 13528.[5] The uncertainty was evaluated as:

$$u_{rob\ av} = \frac{1.25 \times S_{rob\ av}}{\sqrt{p}} \qquad \textit{Equation 4}$$

where:

$u_{rob\ av}$ is the standard uncertainty of the robust average

$S_{rob\ av}$ is the standard deviation of the robust average

$p$ is the number of results

The expanded uncertainty ($U_{rob\ av}$) is the standard uncertainty multiplied by a coverage factor of 2 at approximately 95% confidence level.

A worked example is set out below in Table 89.

Table 89 Uncertainty Evaluation for Robust Average of Sample S2 PFOA

| | |
|---|---|
| No. results (p)* | 32 |
| Robust Average | 2.29 µg/kg |
| $S_{rob\ av}$ | 0.26 µg/kg |
| $u_{rob\ av}$ | 0.057 µg/kg |
| $k$ | 2 |
| $U_{rob\ av}$ | 0.12 µg/kg |

*Extreme outliers excluded

Therefore, the robust average for PFOA in Sample S2 is 2.29 ± 0.12 µg/kg.

### A2.2 z-Score and $E_n$-Score Calculations

For each participant's result, a $z$-score and $E_n$-score are calculated according to Equations 2 and 3 respectively (Section 4).

A worked example is set out below in Table 90.

Table 90 $z$-Score and $E_n$-Score for Sample S2 PFOA Result Reported by Laboratory 29

| Participant Result (µg/kg) | Assigned Value (µg/kg) | Standard Deviation for Proficiency Assessment | $z$-Score | $E_n$-Score |
|---|---|---|---|---|
| 2.377 ± 0.951 | 2.29 ± 0.12 | 20% as PCV, or: 0.2 × 2.29 = 0.458 µg/kg | $z = \frac{2.377 - 2.29}{0.458} = 0.19$ | $E_n = \frac{2.377 - 2.29}{\sqrt{0.951^2 + 0.12^2}} = 0.09$ |

## APPENDIX 3 – USING PT DATA FOR UNCERTAINTY EVALUATION

When a laboratory has successfully participated in at least 6 proficiency testing studies, the standard deviation from proficiency testing studies can also be used to evaluate the uncertainty of their measurement results.[16] Between 2014 and 2025, NMIA carried out eleven proficiency tests of PFAS in soil. These studies involved analyses of PFAS analytes at low and high levels.

Laboratory X participated and submitted acceptable results for PFOA in most of these PTs. All reported results below returned acceptable z-scores (Table 91).

Table 91 Laboratory X Reported Results for PFOA

| Study No. | Sample | Laboratory result µg/kg | Assigned value* µg/kg | Number of Results | Robust CV of all results (%) |
|---|---|---|---|---|---|
| AQA 15-03 | S2 - Soil | 8.34 | 8.9 | 9 | 19 |
| AQA 16-06 | S3 - Soil | 7.45 | 5.83 | 17 | 9.7 |
| AQA 18-09 | S1 - Soil | 6.2 | 6.55 | 23 | 9.7 |
| AQA 18-09 | S2 - Soil | 65.4 | 80.5 | 22 | 11 |
| AQA 19-11 | S1 - Soil | 91.5 | 104 | 24 | 21 |
| AQA 19-11 | S2 - Soil | 1.59 | 1.70 | 24 | 19 |
| AQA 20-10 | S1 - Soil | 520 | 466 | 22 | 16 |
| AQA 20-10 | S2 - Soil | 7.4 | 7.82 | 27 | 16 |
| AQA 21-07 | S1 - Soil | 4.05 | 3.70 | 29 | 15 |
| AQA 21-07 | S2 - Soil | 12.1 | 12.0 | 29 | 9.7 |
| AQA 22-13 | S1 - Soil | 20.8 | 20.4 | 32 | 17 |
| AQA 22-13 | S2 - Soil | 9.71 | 9.67 | 32 | 11 |
| AQA 23-14 | S1 - Soil | 36 | 41.3 | 36 | 16 |
| AQA 23-14 | S2 - Soil | 10 | 10.5 | 37 | 11 |
| AQA 24-13 | S1 - Soil | 545.45 | 550 | 25 | 15 |
| AQA 24-13 | S2 - Soil | 5.56 | 6.50 | 32 | 12 |
| AQA 25-10 | S1 - Soil | 97 | 91.4 | 28 | 18 |
| AQA 25-10 | S2 - Soil | 2.44 | 2.29 | 32 | 11 |
| Average | | | | | 14%* |
| $\boldsymbol{pooled\ s}\% = \sqrt{\frac{(\mathbf{9}-\mathbf{1})\times\mathbf{19^2}+(\mathbf{17}-\mathbf{1})\times\mathbf{9.7^2}+\cdots\ldots\ldots\ldots+(\mathbf{32}-\mathbf{1})\times\mathbf{11^2})}{\mathbf{480}-\mathbf{18}}}$ | | | | | 14% |

*The pooled standard deviation was used.

The pooled standard deviation of the robust CV over these PT samples gives an evaluation of the relative standard uncertainty of 14%. Using a coverage factor of two gives relative expanded uncertainty of 28%, at a level of confidence of approximately 95%. Table 92 sets out the expanded uncertainty for results of the measurement of PFOA in soil.

Table 92 Uncertainty of PFOA Results Evaluated Using PT Data

| Results (µg/kg) | Uncertainty (µg/kg) |
|---|---|
| 1.00 | 0.28 |
| 20.0 | 5.6 |
| 100 | 28 |
| 500 | 140 |
| 1000 | 280 |

The evaluation of 28% passes the test of being reasonable, and the analysis of the 18 different PT samples over eleven years can be assumed to include all the relevant uncertainty components (different matrices, operators, reagents, calibrators etc.), and so complies with ISO/IEC 17025.[7]

## APPENDIX 4 – ADDITIONAL ANALYTES

Table 93 Additional Analytes

| Lab. Code | Sample | Analyte | Result (µg/kg) | Uncertainty (µg/kg) | Recovery (%) |
|---|---|---|---|---|---|
| 2 | S1 | PFUdA | 0.2 | 0.04 | NR |
| 3 | S2 | PFDoA | 0.08 | 0.022 | NR |
| 4 | S1 | 6:2FTS | 1.55 | 0.39 | 106 |
| | S2 | PFHxA | 0.3262 | 0.06 | 90 |
| 5 | S1 | EtFOSAA | 0.58751 | 0.176253 | 63 |
| 6 | S2 | PFHxA | 0.18 | 0.054 | 118 |
| 7 | S3 | MeFOSA | 0.38 | 0.11 | NR |
| 9 | S3 | MeFOSAA | 0.57 | 0.17 | 48 |
| | | 7:3FTCA | 0.635 | 0.159 | 91 |
| 10 | S2 | MeFOSA | 3.35 | 1.005 | 97 |
| | | EtFOSAA | 3.95 | 1.185 | 105 |
| 11 | S2 | PFHxA | 0.011 | 0.0033 | 75.6 |
| | | PFDA | 0.007 | 0.0021 | 83.7 |
| | | PFDoA | 0.075 | 0.0225 | 67.6 |
| | | PFTrDA | 0.011 | 0.00385 | 93.1 |
| | | PFPeS | 0.004 | 0.0012 | 109.1 |
| | | 8:2FTS | 0.003 | 0.0009 | 143.7 |
| 12 | S3 | 7:3FTCA | 1.4 | 0.28 | NR |
| 14 | S1 | MeFOSA | 0.69 | 0.21 | 89 |
| | S3 | PFUdA | 0.12 | 0.04 | 54 |
| 16 | S1 | EtFOSAA | 0.3 | 0.1 | NR |
| 17 | S1 | EtFOSAA | 0.580276 | 0.174082 | 92 |
| 19 | S3 | PFHxDA | 0.101 | 0.0212 | 73 |
| | | 7:3FTCA | 1.7 | 0.382 | 96 |
| 20 | S2 | 8:2FTOH | 0.92 | NR | 110 |
| | S3 | 6:2FTOH | 1.07 | NR | 81 |
| | | 8:2FTOH | 1.02 | NR | 89 |
| 22 | S2 | PFHxA | 0.06 | 0.019 | 118 |
| 23 | S3 | MeFOSAA | 1 | 0.33 | 102 |
| 25 | S1 | 6:2FTS | 39 | NR | NR |
| 27 | S1 | MeFOSA | 0.13 | 0.047 | NT |
| | | EtFOSAA | 0.25 | 0.090 | NT |
| | | MeFOSE | 0.55 | 0.20 | NT |
| | | PFMPA | 0.074 | 0.027 | NT |
| | | PFMBA | 0.13 | 0.047 | NT |

| Lab. Code | Sample | Analyte | Result (µg/kg) | Uncertainty (µg/kg) | Recovery (%) |
|---|---|---|---|---|---|
| 27 | S1 | PFECHS | 3.1 | 1.1 | NT |
| | S3 | PFUdA | 0.54 | 0.24 | NT |
| | | PFHxDA | 0.20 | 0.091 | NT |
| | | MeFOSAA | 1.1 | 0.48 | NT |
| | | MeFOSE | 2.0 | 0.88 | NT |
| | | EtFOSE | 0.43 | 0.19 | NT |
| | | 8:2FTS | 0.10 | 0.047 | NT |
| | | 10:2FTS | 0.30 | 0.14 | NT |
| | | 7:3FTCA | 3.9 | 1.7 | NT |
| | | 9Cl-PF3ONS | 0.037 | 0.017 | NT |
| 28 | S1 | PFECHS | 27 | 14 | NR |
| 29 | S2 | 8:2FTOH | 3.686 | 1.106 | NR |
| 30 | S3 | PFUdA | 0.26 | NR | NR |
| 31 | S1 | PFUdA | 0.3 | 0.038 | 110.06 |
| | | PFECHS | 1.7 | NR | 101.23 |
| 33 | S1 | PFUdA | 0.44 | 0.13 | 62 |
| | | MeFOSA | 0.5505 | 0.17 | 68 |
| 34 | S3 | 7:3FTCA | 0.5 | 0.3 | 106 |
| 35 | S1 | PFUdA | 0.15 | 0.050 | 95.1 |
| | | PFUdS | 2.2 | 0.66 | 91.6 |
| | | PFTrDS | 2.5 | 2.225 | 91.6 |
| | | MeFOSA | 0.56 | 0.112 | 62.8 |
| | | EtFOSAA | 0.53 | 0.106 | 92.5 |
| | | PFECHS | 0.51 | 0.11 | NT |
| | S2 | PFDoA | 0.080 | 0.018 | 106.8 |

## APPENDIX 5 – FALSE NEGATIVES

Table 94 False Negatives

| Lab. Code | Sample | Analyte | Assigned Value (µg/kg) | Spike Value (µg/kg) | Result* (µg/kg) |
|---|---|---|---|---|---|
| 1 | S2 | PFTeDA | 0.635 | 0.735 | NR |
| | | 10:2FTS | 43.2 | 49.1 | NR |
| | | GenX | 13.8 | 14.7 | NR |
| | | 11Cl-PF3OUdS | 2.26** | 4.92 | NR |
| | S3 | PFTeDA | 13.4 | 17.9 | NR |
| | | 6:2FTS | 5.04 | 5.17 | NR |
| | | 11Cl-PF3OUdS | 20.1 | 18.7 | NR |
| 4 | S1 | PFNA | 0.77 | Not spiked | <0.3 |
| | | PFHxS_L | 790 | Not spiked | NR |
| | | PFOS_L | 8020 | Not spiked | NR |
| | | MeFOSAA | 0.68 | Not spiked | <0.3 |
| | S2 | PFTeDA | 0.635 | 0.735 | <0.5 |
| | | PFODA | 3.3** | 5.36 | NR |
| | | PFHxS_L | 1.33 | 1.39 | NR |
| | | PFOS_L | 4.82 | 4.66 | NR |
| | | PFUdS | 16.3** | 19.6 | NR |
| | | PFDoS | 9.6 | 14.8 | NR |
| | | PFTrDS | 10.3** | 14.6 | NR |
| | | 8:2diPAP | 2.05** | 4.90 | NR |
| | | 3:3FTCA | 16.1** | 34.3 | NR |
| | | PFMPA | 26.0 | 29.4 | NR |
| | | PFEESA | 4.97 | 4.91 | NR |
| 6 | S1 | PFNA | 0.77 | Not spiked | <0.001 |
| | | MeFOSAA | 0.68 | Not spiked | <0.001 |
| | S2 | PFTeDA | 0.635 | 0.735 | <0.001 |
| | | PFHxDA | 6.2 | 9.80 | <0.001 |
| | | PFODA | 3.3** | 5.36 | <0.001 |
| | | PFDoS | 9.6 | 14.8 | <0.001 |
| 7 | S3 | PFDA | 12.4 | 11.0 | <0.1 |
| | | PFBS | 6.58 | 6.22 | <0.1 |
| | | PFHpS | 11.1 | 10.3 | <0.1 |
| | | PFOS | 11.4 | 11.5 | <0.1 |
| | | PFOS_L | 9.2 | 9.05 | <0.1 |
| | | PFNS | 1.09 | 1.18 | <0.1 |

| Lab. Code | Sample | Analyte | Assigned Value (µg/kg) | Spike Value (µg/kg) | Result* (µg/kg) |
|---|---|---|---|---|---|
| | | PFDS | 25.5 | 30.7 | <0.1 |
| 8 | S2 | MeFOSAA | 4.34 | 4.90 | < 0.1 |
| 10 | S2 | EtFOSA | 3.16 | 3.43 | <1 |
| | | MeFOSAA | 4.34 | 4.90 | <1 |
| | | GenX | 13.8 | 14.7 | <1 |
| 11 | S2 | PFPeA | 2.41 | 2.44 | NR |
| | | PFHpA | 1.70 | 1.62 | NR |
| | | PFHxDA | 6.2 | 9.80 | NR |
| | | PFODA | 3.3** | 5.36 | NR |
| | | PFOSA | 0.871 | 0.980 | NR |
| | | EtFOSA | 3.16 | 3.43 | NR |
| | | MeFOSAA | 4.34 | 4.90 | NR |
| | | MeFOSE | 4.69 | 4.90 | NR |
| | | 10:2FTS | 43.2 | 49.1 | NR |
| | | 8:2diPAP | 2.05** | 4.90 | NR |
| | | 3:3FTCA | 16.1** | 34.3 | NR |
| | | PFMPA | 26.0 | 29.4 | NR |
| | | PFEESA | 4.97 | 4.91 | NR |
| 12 | S1 | PFNA | 0.77 | Not spiked | NR |
| | | PFDoA | 0.392 | Not spiked | NR |
| | | MeFOSAA | 0.68 | Not spiked | NR |
| | S2 | PFTeDA | 0.635 | 0.735 | NR |
| | | PFODA | 3.3** | 5.36 | NR |
| | | PFOSA | 0.871 | 0.980 | NR |
| | | MeFOSE | 4.69 | 4.90 | NR |
| | | 8:2diPAP | 2.05** | 4.90 | NR |
| | S3 | PFBA | 11.1 | 11.1 | NR |
| | | PFDS | 25.5 | 30.7 | NR |
| 13 | S2 | PFHpA | 1.70 | 1.62 | <1 |
| | | PFBS | 1.91 | 1.95 | <1 |
| | | 11Cl-PF3OUdS | 2.26** | 4.92 | <2 |
| | S3 | PFBA | 11.1 | 11.1 | <10 |
| | | PFBS | 6.58 | 6.22 | <5 |
| | | 11Cl-PF3OUdS | 20.1 | 18.7 | <10 |
| 15 | S2 | PFBA | 2.00 | 1.96 | NR |
| | | PFPeA | 2.41 | 2.44 | NR |
| | | PFHpA | 1.70 | 1.62 | NR |

| Lab. Code | Sample | Analyte | Assigned Value (µg/kg) | Spike Value (µg/kg) | Result* (µg/kg) |
|---|---|---|---|---|---|
| | | PFNA | 1.93 | 1.86 | NR |
| | | PFUdA | 4.40 | 4.41 | NR |
| | | PFTeDA | 0.635 | 0.735 | NR |
| | | PFHxDA | 6.2 | 9.80 | NR |
| | | PFODA | 3.3** | 5.36 | NR |
| | | PFBS | 1.91 | 1.95 | NR |
| | | PFHxS_L | 1.33 | 1.39 | NR |
| | | PFOS_L | 4.82 | 4.66 | NR |
| | | PFUdS | 16.3** | 19.6 | NR |
| | | PFDoS | 9.6 | 14.8 | NR |
| | | PFTrDS | 10.3** | 14.6 | NR |
| | | PFOSA | 0.871 | 0.980 | NR |
| | | EtFOSA | 3.16 | 3.43 | NR |
| | | MeFOSAA | 4.34 | 4.90 | NR |
| | | MeFOSE | 4.69 | 4.90 | NR |
| | | 6:2FTS | 1.94 | 1.95 | NR |
| | | 10:2FTS | 43.2 | 49.1 | NR |
| | | 8:2diPAP | 2.05** | 4.90 | NR |
| | | 3:3FTCA | 16.1** | 34.3 | NR |
| | | GenX | 13.8 | 14.7 | NR |
| | | PFMPA | 26.0 | 29.4 | NR |
| | | 11Cl-PF3OUdS | 2.26**s | 4.92 | NR |
| | | PFEESA | 4.97 | 4.91 | NR |
| 16 | S1 | PFNA | 0.77 | Not spiked | <0.5 |
| 17 | S2 | PFEESA | 4.97 | 4.91 | NR |
| 19 | S1 | PFNA | 0.77 | Not spiked | <0.5 |
| | S3 | PFBA | 11.1 | 11.1 | <0.1 |
| | | 8:2diPAP | 26** | 23 | NR |
| 20 | S1 | PFNA | 0.77 | Not spiked | <0.5 |
| | | MeFOSAA | 0.68 | Not spiked | <0.5 |
| | S3 | PFBA | 11.1 | 11.1 | <10 |
| | | PFHpA | 3.69 | 3.14 | <2.5 |
| | | PFHxS | 2.92 | 2.98 | <2.5 |
| 21 | S1 | PFNA | 0.77 | Not spiked | <0.5 |
| 22 | S1 | PFNA | 0.77 | Not spiked | <0.001 |
| | | MeFOSAA | 0.68 | Not spiked | <0.001 |
| | S2 | PFTeDA | 0.635 | 0.735 | <0.001 |

| Lab. Code | Sample | Analyte | Assigned Value (µg/kg) | Spike Value (µg/kg) | Result* (µg/kg) |
|---|---|---|---|---|---|
| | | PFHxDA | 6.2 | 9.80 | <0.001 |
| | | PFODA | 3.3** | 5.36 | <0.001 |
| | | PFDoS | 9.6 | 14.8 | <0.001 |
| 25 | S1 | PFBA | 26.8 | Not spiked | <5 |
| | | PFHpA | 21.2 | Not spiked | <5 |
| | S2 | PFOS | 6.17 | 5.91 | <5 |
| | S3 | PFBA | 11.1 | 11.1 | <5 |
| | | PFPeA | 5.92 | 5.11 | <5 |
| | | PFOA | 8.40 | 8.29 | <5 |
| | | PFNA | 5.92 | 5.15 | <5 |
| | | PFDA | 12.4 | 11.0 | <5 |
| | | PFTrDA | 8.9 | 13.6 | <5 |
| | | PFTeDA | 13.4 | 17.9 | <5 |
| | | PFBS | 6.58 | 6.22 | <5 |
| | | PFHpS | 11.1 | 10.3 | <5 |
| | | PFOS | 11.4 | 11.5 | <5 |
| | | PFDS | 25.5 | 30.7 | <5 |
| | | PFOSA | 5.10 | 5.15 | <5 |
| | | EtFOSAA | 18.1 | 20.5 | <5 |
| 30 | S3 | PFHxS | 2.92 | 2.98 | NR |
| | | 8:2diPAP | 26** | 23 | NR |
| 31 | S1 | PFHxS_L | 790 | Not spiked | NR |
| | S2 | PFTeDA | 0.635 | 0.735 | <0.5 |
| | | PFODA | 3.3** | 5.36 | NR |
| | | PFHxS_L | 1.33 | 1.39 | NR |
| | | PFUdS | 16.3** | 19.6 | NR |
| | | PFTrDS | 10.3** | 14.6 | NR |
| 32 | S2 | MeFOSE | 4.69 | 4.90 | <1 |
| 33 | S1 | MeFOSAA | 0.68 | Not spiked | < 0.5 |
| 35 | S2 | PFODA | 3.3** | 5.36 | <0.07 |
| 36 | S1 | PFNA | 0.77 | Not spiked | < 0.0010 |
| | | PFDoA | 0.392 | Not spiked | < 0.0010 |
| | | MeFOSAA | 0.68 | Not spiked | < 0.0010 |
| | S2 | PFTeDA | 0.635 | 0.735 | < 0.0010 |
| | | PFOSA | 0.871 | 0.980 | < 0.0010 |

*NR results may or may not be false negatives, depending on the participant's actual LOR.

**Robust Average or Median Value as applicable (assigned value not set).

## APPENDIX 6 – PARTICIPANTS' TEST METHODS

### A6.1 Samples S1 and S2 Soil Methodology

Table 95 Participant Methodology – Sample Preparation and Extraction**

| Lab Code | S1 Sample Weight (g) | S2 Sample Weight (g) | Sample Moistened? | Labelled Std(s) Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 2 | No | Yes | 30 | NA | Alkaline Digestion | 1 | NaOH/MeOH | 90 | Yes | 50 | 45 | None | Not Applicable | No |
| 2 | 2 | 2 | No | Yes | | | QuEChERS | | 5 mM NH4CH3CO2 in ACN/MeOH | 30 | No | | | Filtration | Not Applicable | No |
| 3 | | 2 | No | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/ MeOH | 60 | Yes | 30 | 90 | Carbon S SPE | NH4OH/MeOH | Yes |
| 4 | 0.2g | 1.5 g | Yes | Yes | 30 | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | 10 min each for 3 steps | Yes | | | Solid-Phase Extraction | 1%NH4-MeOH | Yes |
| 5 | 5 | 5 | No | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/ MeOH | 60 | No | Room temperature | No | Filtration | Not Applicable | Yes |
| 6 | 5 | 5 | No | Yes | | | QuEChERS | | ACN:1% H2SO4 | 15 | No | | | Dilution and Filtration | | |
| 7 | 2 | 2 | Yes | Yes | 30 | | Solid-Liquid Extraction (vortexed and centrifuged) | | Basic ACN and Acetone | 30 | Yes | 45 | 30 | None | | No |

| Lab Code | S1 Sample Weight (g) | S2 Sample Weight (g) | Sample Moistened? | Labelled Std(s) Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 | NS | 5 | No | Yes | 24 h | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/ MeOH | 60 | No | | | None | | Yes |
| 9 | 2 | 2 | No | Yes | 0.5 | | Ion Pair Extraction with Solid-Liquid Extraction | | Ammonium acetate in ACN:MeOH | 60 | Yes | N/A | N/A | Filtration | N/A | NA |
| 10 | 2g | 2g | No | Yes | NA | No | Shaker | NA | NH4C2H3O2/MeOH/CAN | 30 | Yes | NA | NA | Solid-Phase Extraction | NH4C2H3O2/ MeOH | No |
| 11 | NS | 2 | Yes | Yes | 15 | Ultrasonification with solvent | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 150 | No | 20 | 150 | Solid-Phase Extraction | MeOH, 0.1% NH3 | No |
| 12 | 0.97 | 1.01 | No | Yes | 0 | | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | KOH/MeOH | 120 | No | 40 | | None | Not Applicable | No |
| 13 | 0.02 to 2 g | 0.5 to 2g | No | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | 120 | Yes | 30 | 120 | Solid-Phase Extraction | NH4OH/MeOH | Yes |
| 14 | 2 | 2 | No | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | No | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 15 | NS | 0.5 g and 1.0 g | NA | Yes | 30 mins | Homogenisation | Sonication | 3 times | Methanol | 30 min x 3 times | Yes | Room temperature | 30 mins | Solid-Phase Extraction | Methanol | NA |
| 16 | | | | | | | | | | | | | | | | |

| Lab Code | S1 Sample Weight (g) | S2 Sample Weight (g) | Sample Moistened? | Labelled Std(s) Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 17 | 5 | 5 | No | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/ MeOH | 60 | No | Room temperature | No | Filtration | Not Applicable | Yes |
| 18 | | | | | | | | | | | | | | | | |
| 19 | 0.5 | 1 | Yes | Yes | 60 | | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | 99/1 methanol/ ammonium hydroxide (v/v). | 2 x 20 min | Yes | 40 | | None | | No |
| 20 | 2 | 2 | No | Yes | | | QuEChERS | | ACN/MeOH in 0.1% NH4OH | 90 | No | 40 | 30 | Filtration | | |
| 21* | 0.1/ 0.5 | 1 | No | Yes | 1 hour | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | 2 hours | Yes | | | Filtration | | Yes |
| 22 | 5 | 5 | No | Yes | | | QuEChERS | | ACN:1% H2SO4 | 15 | No | | | Dilution and Filtration | | |
| 23 | 2 | 2 | Yes | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | NH4OH/ MeOH | 10 | No | | | | | Yes |
| 24 | 2.024 / 0.996 | 2.015 / 0.997 | No | Yes | | | QuEChERS | | 5mM ammonium acetate in CAN/MeOH | 45 mins | Yes | | | | | |

| Lab Code | S1 Sample Weight (g) | S2 Sample Weight (g) | Sample Moistened? | Labelled Std(s) Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 25 | 0.0996 | 0.1024 | No | Yes | None | | Solid-Liquid Extraction (vortexed and centrifuged) | | | | Yes | | | | | No |
| 27 | 5 | 5 | No | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NaOH/MeOH | 45 | Yes | RT | | Envicarb | | Yes |
| 28 | 1 | 1 | | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | Extraction with MeOH/Ammonium hydroxide 99:1 | | | | | Solid-Phase Extraction | 10:89:1 IPA/ACN/Ammonium hydroxide | |
| 29* | 5 (LC-MSMS) / 5 (GC-NCI-MS) | 5 -> 1 (LC-MSMS) / 5 (GC-NCI-MS) | No | Yes | No | No | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH (LC-MS/MS) / MTBE (GC-NCl-MS) | 60 (LC-MS/MS) / 120 (GC-NCI-MS) | No | 40 (LC-MS/MS) / RT (GC-NCI-MS) | 20 (LC-MS/MS) / N/A (GC-NCI-MS) | None | Not Applicable | No |
| 30 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 31 | Yes | Yes | n/a | Yes | Yes | n/a | Yes | Yes | None | None | ACN /MeOH | 45 min | Room temp | n/a | n/a | None |
| 32 | | | | | | | | | | | | | | | | |
| 33 | 2 | 2 | No | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | Yes | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 34 | 5 | 5 | No | Yes | 10 | Homogenisation | Alkaline Digestion | N/A | Basic MeOH | 60 | No | N/A | N/A | None | N/A | Yes |

| Lab Code | S1 Sample Weight (g) | S2 Sample Weight (g) | Sample Moistened? | Labelled Std(s) Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35 | 1.0758 | 1.0357 | No | Yes | 15 | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4C2H3O2/MeOH | 60 | Yes | 20 | visual verification | Solid-Phase Extraction | ACN | No |
| 36 | 2, 0.2 | 2 | Yes | Yes | 30 | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH 75% | 60 min | No | N/A | N/A | Filtration | Not Applicable | Yes |
| 37 | 2 | 2 | No | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | No | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 38 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

*Additional Information in Table 96.

**Some responses may have been modified so that the participant cannot be identified.

Table 96 Participant Methodology – Extraction Additional Information

| Lab. Code | Extraction Additional Information |
|---|---|
| 21 | Active carbon cleanup |
| 29 | with buffer (only LC-MS/MS) |

Table 97 Participant Methodology – Instrumental Technique and Analysis

| Lab. Code | Instrument | Dilution Factor | Blank Correction? |
|---|---|---|---|
| 1 | LC-MSMS or LC-QQQ | No | No |
| 2 | LC-MSMS or LC-QQQ | | No |
| 3 | LC-MSMS or LC-QQQ | | No |
| 4 | LC-MSMS or LC-QQQ | No | No |
| 5 | LC-MSMS or LC-QQQ | 20, 200 and 4000 | No |
| 6 | LC-Orbitrap | 8 | Yes |
| 7 | LC-MSMS or LC-QQQ | | No |
| 8 | LC-MSMS or LC-QQQ | | Yes |
| 9 | LC-MSMS or LC-QQQ | No | No |
| 10 | LC-MSMS or LC-QQQ | Yes - x10 and x100 dilution | Yes |
| 11 | LC-MSMS or LC-QQQ | 4.86E-02 | NA |
| 12 | LC-MSMS or LC-QQQ | | No |
| 13 | LC-MSMS or LC-QQQ | x10 | No |
| 14 | LC-MSMS or LC-QQQ | Yes, 10x | No |
| 15 | LC-MSMS or LC-QQQ | No | No |
| 16 | | | |
| 17 | LC-MSMS or LC-QQQ | 20, 200 and 4000 | No |
| 18 | | | |

| Lab. Code | Instrument | Dilution Factor | Blank Correction? |
|---|---|---|---|
| 19 | LC-MSMS or LC-QQQ | No | No |
| 20 | LC-MSMS or LC-QQQ | No | No |
| 21 | LC-MSMS or LC-QQQ | | No |
| 22 | LC-Orbitrap | 8 | Yes |
| 23 | LC-MSMS or LC-QQQ | 2 | No |
| 24 | LC-MSMS or LC-QQQ | 200 for S1 | No |
| 25 | LC-MSMS or LC-QQQ | No | No |
| 27 | LC-MSMS or LC-QQQ | | No |
| 28 | LC-Orbitrap | x1 and x10. S1 further dilutions of x20 using the x10 | No |
| 29 | LC-MSMS, GC-MS im NCl (only FTOH) | ? (LC-MS/MS) / No (GC-NCI-MS) | No |
| 30 | NS | NS | NS |
| 31 | LC-MSMS or LC-QQQ | No | No |
| 32 | | | |
| 33 | LC-MSMS or LC-QQQ | Yes, 10x | No |
| 34 | LC-MSMS or LC-QQQ | 5 | No |
| 35 | LC-MSMS or LC-QQQ | | Yes |
| 36 | LC-MSMS or LC-QQQ | | No |
| 37 | LC-MSMS or LC-QQQ | Yes, 10x | No |
| 38 | NS | NS | NS |

Table 98 Participant Methodology – Labelled Standards

| Lab. Code | Labelled Standard Source | Secondary Source Used to Check Standard? | Recovery Correction? | Standard Method Used? |
|---|---|---|---|---|
| 1 | Wellington | No | Yes | No |
| 2 | Wellington | Yes | Yes | |
| 3 | Wellington | Yes | Yes | |
| 4 | | | | |
| 5 | Wellingtion | Yes | Yes | No |
| 6 | Wellington Laboratories | | Yes | |
| 7 | Wellington | Yes | No | No |
| 8 | Wellington | | Yes | |
| 9 | Wellington | Yes | Yes | In-house |
| 10 | Wellington Labs | Yes | Yes | No |
| 11 | Wellington Laboratories; LGC | No | No | No |
| 12 | Wellington Laboratories | | Yes | USEPA 537 |
| 13 | Wellington Laboratory and Cambridge Isotope Laboratory | Yes | Yes | In house based on US EPA 1633 |
| 14 | Wellington | | Yes | |
| 15 | Wellington | Yes | No | NA |
| 16 | | | | |
| 17 | Wellingtion | Yes | Yes | No |
| 18 | | | | |
| 19 | Wellington | No | Yes | Isotopic dilution |
| 20 | Wellington Laboratories | Yes | Yes | |
| 21 | Wellington Laboratories | No | No | EPA 1663 |

| Lab. Code | Labelled Standard Source | Secondary Source Used to Check Standard? | Recovery Correction? | Standard Method Used? |
|---|---|---|---|---|
| 22 | Wellington Laboratories | | Yes | |
| 23 | Wellington Labs | Yes | No | |
| 24 | Wellington | Only for the ICV | No | QuEChERS |
| 25 | Wellington Laboratory | No | Yes | USEPA 1633 |
| 27 | Greyhound, Wellington, TLC, LGC | | No | DIN 38414-14 |
| 28 | Wellington | | Yes | |
| 29 | Wellington | | Yes | DIN 38414-14 : 2011-08 |
| 30 | NS | NS | NS | NS |
| 31 | Wellington Laboratories | | No | No |
| 32 | | | | |
| 33 | Wellington | YES | Yes | Extracted Isotope Dilution |
| 34 | Wellington | | Yes | No. Inhouse |
| 35 | Wellington | Yes | Yes | No |
| 36 | Wellington | Yes | Yes | ASTM-D7968 modified |
| 37 | | | | |
| 38 | NS | NS | NS | NS |

Table 99 Labelled Standards for PFBA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M4PFBA | NA |
| 2 | ISTD | |
| 3 | PBA-13C4 | Yes |
| 4 | MPFBA | |
| 5 | PFBA-13C4 | |
| 6 | Yes | |
| 7 | 13C4-PFBA | |
| 8 | PFBA | |
| 9 | 13C4-PFBA | NA |
| 10 | 13C4-PFBA | No |
| 11 | 13C4-PFBA | 13C2-PFHxA |
| 12 | MPFBA | M3PFBA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFBA-13C4 | |
| 18 | | |
| 19 | 13C4-PFBA | 13C3-PFBA |
| 20 | 13C4-PFBA | |
| 21 | PFBA-13C4; PFBA-13C3 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C4-PFBA | N/A |
| 25 | | |
| 27 | 13C4-PFBA | |
| 28 | Perfluoro-n-[13C4]butanoic acid MPFBA | Perfluoro-n-[2,3,4-13C4]butanoic acid M3PFBA |
| 29 | INT_13C4-PFBA | |
| 30 | NS | NS |
| 31 | 13C4-PFBA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFBA | N/A |
| 35 | IS-PFBA | |
| 36 | M4PFBA | M3PFBA |
| 37 | YES | |
| 38 | NS | NS |

Table 100 Labelled Standards for PFPeA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFPeA | NA |
| 2 | ISTD | |
| 3 | PFPeA-13C3 | Yes |
| 4 | M5PFPeA | |
| 5 | PFPeA-13C3 | |
| 6 | Yes | |
| 7 | 13C5-PFPeA | |
| 8 | PFPeA | |
| 9 | 13C5-PFPeA | NA |
| 10 | 13C5-PFPeA | No |
| 11 | 13C5-PFPeA | 13C2-PFHxA |
| 12 | M5PFPeA | M3PFBA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFPeA-13C3 | |
| 18 | | |
| 19 | 13C4-PFPeA | 13C5 -PFPeA |
| 20 | 13C5-PFPeA | |
| 21 | PFPeA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C5-PFPeA | N/A |
| 25 | | |
| 27 | 13C5-PFPeA | |
| 28 | Perfluoro-n-[13C5]pentanoic acid M5PFPeA | |
| 29 | INT_13C2-PFHxA | |
| 30 | NS | NS |
| 31 | 13C5-PFPeA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C3-PFPeA | N/A |
| 35 | IS-PFPeA | |
| 36 | M5PFPeA | M2PFHxA |
| 37 | YES | |
| 38 | NS | NS |

Table 101 Labelled Standards for PFHxA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFHxA | NA |
| 2 | ISTD | |
| 3 | PFHxA-13C2 | Yes |
| 4 | M5PFHxA | |
| 5 | PFHxA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFHxA | |
| 8 | PFHxA | |
| 9 | 13C5-PFHxA | NA |
| 10 | 13C5-PFHxA | No |
| 11 | 13C5-PFHxA | 13C2-PFHxA |
| 12 | M5PFHxA | M3PFBA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFHxA-13C2 | |
| 18 | | |
| 19 | 13C2-PFHxA | 13C5 -PFPeA |
| 20 | 13C5-PFHxA | |
| 21 | PFHxA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C5-PFHxA | N/A |
| 25 | | |
| 27 | 13C5-PFHxA | |
| 28 | Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid M5PFHxA | Perfluoro-n-[1,2-13C5]hexanoic acid MPFHxA |
| 29 | INT_13C2-PFHxA | |
| 30 | NS | NS |
| 31 | 13C5-PFHxA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFHxA | N/A |
| 35 | IS-PFHxA | |
| 36 | M5PFHxA | M2PFHxA |
| 37 | YES | |
| 38 | NS | NS |

## Table 102 Labelled Standards for PFHpA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFHpA | NA |
| 2 | ISTD | |
| 3 | PFHpA-13C4 | Yes |
| 4 | M4PFHpA | |
| 5 | PFHpA-13C4 | |
| 6 | Yes | |
| 7 | 13C4-PFHpA | |
| 8 | PFHpA | |
| 9 | 13C4-PFHpA | NA |
| 10 | 13C4-PFHpA | No |
| 11 | 13C4-PFHpA | 13C2-PFHxA |
| 12 | M4PFHpA | M3PFBA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFHpA-13C4 | |
| 18 | | |
| 19 | 13C3-PFHpA | 13C8-PFOA |
| 20 | 13C4-PFHpA | |
| 21 | PFHpA-13C4 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C4-PFHpA | N/A |
| 25 | | |
| 27 | 13C4-PFHpA | |
| 28 | Perfluoro-n-[1,2,3,4-13C4]heptanoic acid M4PFHpA | |
| 29 | INT_13C4-PFHpA | |
| 30 | NS | NS |
| 31 | 13C4-PFHpA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFHpA | N/A |
| 35 | IS-PFHpA | |
| 36 | M4PFHpA | M2PFHxA |
| 37 | YES | |
| 38 | NS | NS |

## Table 103 Labelled Standards for PFOA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOA | NA |
| 2 | ISTD & Surrogate | |
| 3 | PFOA-13C8 | Yes |
| 4 | M8PFOA | |
| 5 | PFOA-13C4 | PFOA-13C2 |
| 6 | Yes | |
| 7 | 13C8-PFOA | |
| 8 | PFOA | |
| 9 | 13C4-PFOA | NA |
| 10 | 13C8-PFOA | No |
| 11 | 13C8-PFOA | 13C2-PFOA |
| 12 | M8PFOA | M2PFOA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | [13C4]-PFOA | |
| 16 | | |
| 17 | PFOA-13C4 | PFOA-13C2 |
| 18 | | |
| 19 | 13C4-PFOA | 13C8-PFOA |
| 20 | 13C8-PFOA | |
| 21 | PFOA-13C4; PFOA-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C8-PFOA | N/A |
| 25 | | |
| 27 | 13C4-PFOA | |
| 28 | Perfluoro-n-[13C8]octanoic acid M8PFOA | Perfluoro-n-[1,2,3,4-13C8]octanoic acid MPFOA |
| 29 | INT_13C4-PFOA | |
| 30 | NS | NS |
| 31 | 13C4-PFOA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOA | N/A |
| 35 | IS-PFOA | |
| 36 | M8PFOA | M2PFOA |
| 37 | YES | |
| 38 | NS | NS |

## Table 104 Labelled Standards for PFNA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M9PFNA | NA |
| 2 | ISTD | |
| 3 | PFDA-13C2 | Yes |
| 4 | M9PFNA | |
| 5 | PFNA-13C5 | |
| 6 | Yes | |
| 7 | 13C5-PFNA | |
| 8 | PFNA | |
| 9 | 13C5-PFNA | NA |
| 10 | 13C9-PFNA | No |
| 11 | 13C9-PFNA | 13C5-PFNA |
| 12 | M9PFNA | M2PFOA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFNA-13C5 | |
| 18 | | |
| 19 | 13C5-PFNA | 13C8-PFOA |
| 20 | 13C5-PFNA | |
| 21 | PFNA-13C9; PFNA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C9-PFNA | N/A |
| 25 | | |
| 27 | 13C5-PFNA | |
| 28 | Perfluoro-n-[13C9]nonanoic acid M9PFNA | Perfluoro-n-[1,2,3,4,5-13C9]nonanoic acid MPFNA |
| 29 | INT_13C9-PFNA | |
| 30 | NS | NS |
| 31 | 13C5-PFNA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C5-PFNA | N/A |
| 35 | IS-PFNA | |
| 36 | M9PFNA | M5PFNA |
| 37 | YES | |
| 38 | NS | NS |

## Table 105 Labelled Standards for PFDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M6PFDA | NA |
| 2 | ISTD | |
| 3 | PFDA-13C2 | Yes |
| 4 | M6PFDA | |
| 5 | PFDA-13C2 | |
| 6 | | |
| 7 | 13C6-PFDA | |
| 8 | PFDA | |
| 9 | 13C6-PFDA | NA |
| 10 | 13C6-PFDA | No |
| 11 | 13C6-PFDA | 13C5-PFNA |
| 12 | M6PFDA | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFDA-13C2 | |
| 18 | | |
| 19 | 13C2-PFDA | 13C8-PFOA |
| 20 | 13C6-PFDA | |
| 21 | PFDA-13C6; PFDA-13C2 | |
| 22 | | |
| 23 | yes | |
| 24 | 13C6PFDA | N/A |
| 25 | | |
| 27 | 13C6-PFDA | |
| 28 | Perfluoro-n-[1,2,3,4,6-13C6]decanoic acid M6PFDA | Perfluoro-n-[1,2-13C6]decanoic acid MPFDA |
| 29 | INT_13C6-PFDA | |
| 30 | NS | NS |
| 31 | 13C6-PFDA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFDA | N/A |
| 35 | IS-PFDA | |
| 36 | M6PFDA | M2PFDA |
| 37 | YES | |
| 38 | NS | NS |

## Table 106 Labelled Standards for PFUdA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M7PFUnDA | NA |
| 2 | ISTD | |
| 3 | PFDA-13C2 | Yes |
| 4 | M7PFUdA | |
| 5 | PFUdA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFUnA | |
| 8 | PFUdA | |
| 9 | 13C2-PFUnDA | NA |
| 10 | 13C7-PFUdA | No |
| 11 | 13C7-PFUdA | 13C5-PFNA |
| 12 | M7PFUdA | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFUdA-13C2 | |
| 18 | | |
| 19 | 13C2-PFUdA | 13C8-PFOA |
| 20 | 13C2-PFUnDA | |
| 21 | PFUdA-13C7 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C7-PFUnDA | N/A |
| 25 | | |
| 27 | 13C7-PFUdA | |
| 28 | Perfluoro-n-[1,2,3,4,6,7-13C7]undecanoic acid M7PFUdA | |
| 29 | INT_13C2-PFUnDA | |
| 30 | NS | NS |
| 31 | 13C2-PFUnDA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFUdA | N/A |
| 35 | IS-PFUnDA | |
| 36 | M7PFUnDA | M2PFDA |
| 37 | YES | |
| 38 | NS | NS |

## Table 107 Labelled Standards for PFDoA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | ISTD | |
| 3 | PFDoA-13C2 | Yes |
| 4 | MPFDoA | |
| 5 | PFDoA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFDoA | |
| 8 | PFDoA | |
| 9 | 13C2-PFDoDA | NA |
| 10 | 13C2-PFDoDA | No |
| 11 | 13C2-PFDoA | 13C5-PFNA |
| 12 | MPFDoA | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFDoA-13C2 | |
| 18 | | |
| 19 | 13C2-PFDoA | 13C8-PFOA |
| 20 | 13C2-PFDoDA | |
| 21 | PFDoA-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C2-PFDoDA | N/A |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | Perfluoro-n-[1,2 13C2]dodecanoic acid MPFDoA | |
| 29 | INT_13C2-PFDoDA | |
| 30 | NS | NS |
| 31 | 13C2-PFDoDA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFDoDA | N/A |
| 35 | IS-PFDoDA | |
| 36 | M2PFDoDA | M2PFDA |
| 37 | YES | |
| 38 | NS | NS |

Table 108 Labelled Standards for PFTeDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFTeDA | NA |
| 2 | ISTD | |
| 3 | PFTeDA-13C2 | Yes |
| 4 | M2PFTeDA | |
| 5 | PFTeDA-13C2 | |
| 6 | | |
| 7 | 13C2-PFTeDA | |
| 8 | PFTeDA | |
| 9 | 13C2-PFTeDA | NA |
| 10 | 13C2-PFTeDA | No |
| 11 | 13C2-PFTeDA | 13C5-PFNA |
| 12 | M2PFTeDA | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFTeDA-13C2 | |
| 18 | | |
| 19 | 13C2-PFTeDA | 13C8-PFOA |
| 20 | 13C2-PFTeDA | |
| 21 | PFTeDA-13C2 | |
| 22 | | |
| 23 | yes | |
| 24 | 13C2-PFTeDA | N/A |
| 25 | | |
| 27 | 13C2-PFTeDA | |
| 28 | Perfluoro-n-[1,2 13C2]tetradecanoic acid M2PFTeDA | |
| 29 | INT_13C2-PFTeDA | |
| 30 | NS | NS |
| 31 | 13C2-PFTeDA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFTeDA | N/A |
| 35 | IS-PFTeDA | |
| 36 | M2PFTeDA | M2PFDA |
| 37 | YES | |
| 38 | NS | NS |

Table 109 Labelled Standards for PFHxDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | ISTD | |
| 3 | PFHxDA-13C3 | Yes |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | PFHxDA | |
| 9 | 13C2-PFHxDA | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M2PFHxDA | M2PFOA |
| 13 | Yes | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C2-PFHxDA | 13C8-PFOA |
| 20 | 13C2-PFHxDA | |
| 21 | PFHxDA-13C2 | |
| 22 | | |
| 23 | | |
| 24 | 13C2-PFHxDA | N/A |
| 25 | | |
| 27 | 13C2-PFHxDA | |
| 28 | | |
| 29 | INT_13C2-PFHxDA | |
| 30 | NS | NS |
| 31 | 13C2-PFHxDA | |
| 32 | | |
| 33 | NA | NO |
| 34 | NT | NT |
| 35 | IS-PFHxDA | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

Table 110 Labelled Standards for PFODA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | PFHxDA-13C3 | Yes |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | PFHxDA | |
| 9 | NT | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M8FOSA-I | MPFOS |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C2-PFHxDA | 13C8-PFOA |
| 20 | Not applicable | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | NA | N/A |
| 25 | | |
| 27 | 13C2-PFHxDA | |
| 28 | | |
| 29 | INT_13C2-PFHxDA | |
| 30 | NS | NS |
| 31 | -- | |
| 32 | | |
| 33 | NA | NO |
| 34 | NT | NT |
| 35 | IS-PFHxDA | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

## Table 111 Labelled Standards for PFBS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFBS | NA |
| 2 | ISTD | |
| 3 | PFBS-13C3 | Yes |
| 4 | M3PFBS | |
| 5 | PFBS-1C3 | |
| 6 | Yes | |
| 7 | 13C3-PFBS | |
| 8 | PFBS | |
| 9 | 13C3-PFBS | NA |
| 10 | 13C3-PFBS-Na | No |
| 11 | 13C3-PFBS | 13C4-PFOS |
| 12 | M3PFBS | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFBS-1C3 | |
| 18 | | |
| 19 | 13C3-PFBS | 13C3-PFHxS |
| 20 | 13C3-PFBS | |
| 21 | PFBS-13C3 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C3-PFBS | N/A |
| 25 | | |
| 27 | 13C3-PFBS | |
| 28 | Sodium perfluoro-1-[2,3,4 13C3] butanesulfonate M3PFBS | |
| 29 | INT_13C3-PFBS | |
| 30 | NS | NS |
| 31 | 13C3-PFBS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C3-PFBS | N/A |
| 35 | IS-PFBS | |
| 36 | M3PFBS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

## Table 112 Labelled Standards for PFPeS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFHxA | NA |
| 2 | | |
| 3 | PFHxS-13C3 | Yes |
| 4 | | |
| 5 | PFHxS-18O2 | |
| 6 | Yes | |
| 7 | 13C3-PFBS | |
| 8 | PFHxS | |
| 9 | 16O2-PFHxS | NA |
| 10 | 13C3-PFHxS-Na | No |
| 11 | 13C3-PFPeS | 13C4-PFOS |
| 12 | M3PFBS | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFHxS-18O2 | |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | 16O2-PFHxS | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | 13C3-PFHxS | N/A |
| 25 | | |
| 27 | 13C3-PFBS | |
| 28 | | |
| 29 | INT_13C3-PFHxS | |
| 30 | NS | NS |
| 31 | 18O2-PFHxS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 18O2-PFHxS | N/A |
| 35 | IS-PFHxS | |
| 36 | M3PFHxS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

## Table 113 Labelled Standards for PFHxS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | ISTD | |
| 3 | | |
| 4 | M3PFHxS | |
| 5 | PFHxS-18O2 | PFHxS-13C3 |
| 6 | Yes | |
| 7 | 18O2-PFHxS | |
| 8 | | |
| 9 | 16O2-PFHxS | NA |
| 10 | 13C3-PFHxS-Na | No |
| 11 | 13C3-PFHxS | 13C4-PFOS |
| 12 | M3PFHxS | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | [13C3]-PFHxS | |
| 16 | | |
| 17 | PFHxS-18O2 | PFHxS-13C3 |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | 16O2-PFHxS | |
| 21 | PFHxS-13C3; PFHxS-18O2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C3-PFHxS | N/A |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | Sodium perfluoro-1-[1,2,3 13C3] hexanesulfonate M3PFHxS | Sodium perfluoro-1-hexane (1O2) sulfonate MPFHxS |
| 29 | INT_13C3-PFHxS | |
| 30 | NS | NS |
| 31 | 18O2-PFHxS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 18O2-PFHxS | N/A |
| 35 | IS-PFHxS | |
| 36 | M3PFHxS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

Table 114 Labelled Standards for PFHxS_L

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | | |
| 3 | PFHxS-13C3 | Yes |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 18O2-PFHxS | |
| 8 | PFHxS | |
| 9 | NT | NA |
| 10 | 13C3-PFHxS-Na | No |
| 11 | 13C3-PFHxS | 13C4-PFOS |
| 12 | M3PFHxS | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | Not applicable | |
| 21 | PFHxS-13C3; PFHxS-18O2 | |
| 22 | | |
| 23 | yes | |
| 24 | N/A | N/A |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | | |
| 29 | INT_13C3-PFHxS | |
| 30 | NS | NS |
| 31 | -- | |
| 32 | | |
| 33 | YES | NO |
| 34 | 18O2-PFHxS | N/A |
| 35 | IS-PFHxS | |
| 36 | M3PFHxS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

Table 115 Labelled Standards for PFHpS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | | |
| 3 | PFOS-13C4 | Yes |
| 4 | | |
| 5 | PFOS-13C4 | |
| 6 | Yes | |
| 7 | 18O2-PFHxS | |
| 8 | PFOA | |
| 9 | 16O2-PFHxS | NA |
| 10 | 13C3-PFHxS-Na | No |
| 11 | 13C3-PFHpS | 13C4-PFOS |
| 12 | M3PFHxS | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | PFOS-13C4 | |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | | |
| 29 | INT_13C3-PFHxS | |
| 30 | NS | NS |
| 31 | 18O2-PFHxS | |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFHxS | |
| 36 | M8PFOS | M2PFOS |
| 37 | YES | |
| 38 | NS | NS |

Table 116 Labelled Standards for PFOS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | ISTD & Surrogate | |
| 3 | PFOS-13C4 | Yes |
| 4 | M8PFOS | |
| 5 | PFOS-13C4 | PFOS-13C8 |
| 6 | Yes | |
| 7 | 13C8-PFOS | |
| 8 | PFOS | |
| 9 | 13C8-PFOS | NA |
| 10 | 13C8-PFOS-Na | No |
| 11 | 13C8-PFOS | 13C4-PFOS |
| 12 | M8PFOS | MPFOS |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | [13C4]-PFOS | |
| 16 | | |
| 17 | PFOS-13C4 | PFOS-13C8 |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C4-PFOS | |
| 21 | PFOS-13C8; PFOS-13C4 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | Sodium perfluoro-1-[ 13C8] ocatanesulfonate M8PFOS | Sodium perfluoro-1-[ 1,2,3,4-13C4] ocatanesulfonate MPFOS |
| 29 | INT_13C8-PFOS | |
| 30 | NS | NS |
| 31 | 13C8-PFOS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFOS | |
| 36 | M8PFOS | M2PFOS |
| 37 | YES | |
| 38 | NS | NS |

Table 117 Labelled Standards for PFOS_L

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | | |
| 3 | PFOS-13C4 | Yes |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 13C8-PFOS | |
| 8 | PFOS | |
| 9 | NT | NA |
| 10 | 13C8-PFOS-Na | No |
| 11 | 13C8-PFOS | 13C4-PFOS |
| 12 | M8PFOS | MPFOS |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | PFOS-13C8; PFOS-13C4 | |
| 22 | | |
| 23 | yes | |
| 24 | N/A | N/A |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | INT_13C8-PFOS | |
| 30 | NS | NS |
| 31 | 13C8-PFOS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFOS | |
| 36 | M8PFOS | M2PFOS |
| 37 | YES | |
| 38 | NS | NS |

Table 118 Labelled Standards for PFNS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 13C8-PFOS | |
| 8 | PFHxS | |
| 9 | 13C8-PFOS | NA |
| 10 | 13C8-PFOS-Na | No |
| 11 | 13C3-PFNS | 13C4-PFOS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | INT_13C8-PFOS | |
| 30 | NS | NS |
| 31 | 13C8-PFOS | |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFOS | |
| 36 | M8PFOS | M2PFOS |
| 37 | YES | |
| 38 | NS | NS |

Table 119 Labelled Standards for PFDS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | | |
| 3 | PFOS-13C4 | Yes |
| 4 | | |
| 5 | PFUdA-13C2 | |
| 6 | | |
| 7 | 13C8-PFOS | |
| 8 | PFHxS | |
| 9 | 13C8-PFOS | NA |
| 10 | 13C8-PFOS-Na | No |
| 11 | 13C3-PFDS | 13C4-PFOS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | | |
| 29 | INT_13C2-PFDoDA | |
| 30 | NS | NS |
| 31 | 13C8-PFOS | |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFOS | |
| 36 | M8PFOS | M2PFOS |
| 37 | YES | |
| 38 | NS | NS |

Table 120 Labelled Standards for PFUdS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | NT | NA |
| 10 | NT | NT |
| 11 | 13C3-PFUdS | 13C4-PFOS |
| 12 | NT | NT |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | Not applicable | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | NA | N/A |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | | |
| 29 | INT_13C8-PFOSA | |
| 30 | NS | NS |
| 31 | -- | |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | IS-PFOS | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

Table 121 Labelled Standards for PFDoS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | 13C2-PFTeDA | NA |
| 10 | NT | NT |
| 11 | 13C2-PFTeDA | 13C4-PFOS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C2-PFTeDA | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | | |
| 29 | INT_13C8-PFOSA | |
| 30 | NS | NS |
| 31 | 13C8-PFOS | |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | IS-PFOS | |
| 36 | M8PFOS | M2PFOS |
| 37 | | |
| 38 | NS | NS |

Table 122 Labelled Standards for PFTrDS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | NT | NA |
| 10 | NT | NT |
| 11 | 13C3-PFTrDS | 13C4-PFOS |
| 12 | NT | NT |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | Not applicable | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | NA | N/A |
| 25 | | |
| 27 | 13C2-PFTeDA | |
| 28 | | |
| 29 | INT_13C8-PFOSA | |
| 30 | NS | NS |
| 31 | -- | |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | IS-PFOS | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

Table 123 Labelled Standards for PFOSA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFOSA | NA |
| 2 | ISTD | |
| 3 | PFOSA-13C8 | Yes |
| 4 | M8FOSA | |
| 5 | FOSA-13C8 | |
| 6 | Yes | |
| 7 | 13C8-FOSA | |
| 8 | PFOSA | |
| 9 | 13C8-FOSA | NA |
| 10 | 13C8-FOSA | No |
| 11 | - | - |
| 12 | M8FOSA-I | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | FOSA-13C8 | |
| 18 | | |
| 19 | 13C8-FOSA | |
| 20 | 13C8-FOSA | |
| 21 | FOSA-13C8 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C8-PFOSA | N/A |
| 25 | | |
| 27 | 13C8-PFOSA | |
| 28 | N-methyl-d3-perfluoro-1-octancesulfonamide M8FOSA | |
| 29 | INT_13C8-PFOSA | |
| 30 | NS | NS |
| 31 | 13C8-FOSA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C8-FOSA | N/A |
| 35 | IS-PFOSA | |
| 36 | M8FOSA | M2PFOS. M2PFDA for S1 |
| 37 | YES | |
| 38 | NS | NS |

Table 124 Labelled Standards for EtFOSA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | d-NEtFOSA-M | NA |
| 2 | ISTD | |
| 3 | | |
| 4 | d-N-Et-FOSA-M | |
| 5 | EtFOSA-D5 | |
| 6 | Yes | |
| 7 | d5-N-EtFOSA | |
| 8 | EtFOSA | |
| 9 | d5-EtFOSA | NA |
| 10 | D5-N-EtFOSA-M | No |
| 11 | - | - |
| 12 | d-N-EtFOSA-M | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | EtFOSA-D5 | |
| 18 | | |
| 19 | D5-N-Et FOSA | |
| 20 | d5-EtFOSA | |
| 21 | N-EtFOSA-D5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | D5-NEtFOSA | N/A |
| 25 | | |
| 27 | d5-ETFOSA | |
| 28 | N-ethyl-d5-perfluoro-1-octanesulfonamide d-N-EtFOSA | |
| 29 | INT_d5-N-EtFOSA | |
| 30 | NS | NS |
| 31 | d5-EtFOSA | |
| 32 | | |
| 33 | YES | NO |
| 34 | D5-E PFOSA | N/A |
| 35 | IS-EtPFOSA | |
| 36 | d5-NEtFOSA | M2PFOS. M2PFDA for S1 |
| 37 | YES | |
| 38 | NS | NS |

Table 125 Labelled Standards for MeFOSAA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | d3-NMeFOSAA | NA |
| 2 | ISTD | |
| 3 | N-MeFOSAA-D3 | Yes |
| 4 | d3-N-MeFOSAA | |
| 5 | MeFOSAA-D3 | |
| 6 | Yes | |
| 7 | d3-N-MeFOSAA | |
| 8 | PFHpA | |
| 9 | d3-MeFOSAA | NA |
| 10 | D3-N-MeFOSAA | No |
| 11 | - | - |
| 12 | d3-N-MeFOSAA | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | MeFOSAA-D3 | |
| 18 | | |
| 19 | D3-N-Me FOSAA | |
| 20 | d3-MeFOSAA | |
| 21 | N-MeFOSAA-2H3 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | D3-NMeFOSAA | N/A |
| 25 | | |
| 27 | d3-MeFOSAA | |
| 28 | N-methyl-d3-perfluoro-1-octanesulfonamidoacetic acid d3-N-MeFOSAA | |
| 29 | INT_d3-N-MeFOSAA | |
| 30 | NS | NS |
| 31 | d3-MeFOSAA | |
| 32 | | |
| 33 | YES | NO |
| 34 | D3-Me-FOSAA | N/A |
| 35 | IS-MePFOSAA | |
| 36 | d3-NMeFOSAA | M2PFOS. M2PFDA for S1 |
| 37 | YES | |
| 38 | NS | NS |

Table 126 Labelled Standards for MeFOSE

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | d7-NMeFOSE-M | NA |
| 2 | ISTD | |
| 3 | | |
| 4 | d7-N-MeFOSE-M | |
| 5 | MeFOSE-D7 | |
| 6 | Yes | |
| 7 | d7-N-MeFOSE | |
| 8 | | |
| 9 | d7-MeFOSE | NA |
| 10 | D7-N-MeFOSE-M | No |
| 11 | - | - |
| 12 | d7-N-MeFOSE-M | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | MeFOSE-D7 | |
| 18 | | |
| 19 | D7-N-Me FOSE | |
| 20 | d7-MeFOSE | |
| 21 | N-MeFOSE-D7 | |
| 22 | Yes | |
| 23 | | |
| 24 | D7-NMeFOSE | N/A |
| 25 | | |
| 27 | d7-MeFOSE | |
| 28 | 2-(N-methyl-d7-perfluoro-1-octanesulfonamido) ethan-d4-ol d7-N-MeFOSE | |
| 29 | | |
| 30 | NS | NS |
| 31 | d7-MeFOSE | |
| 32 | | |
| 33 | YES | NO |
| 34 | D7-Me-FOSE | N/A |
| 35 | | |
| 36 | d7-NMeFOSE | M2PFOS. M2PFDA for S1 |
| 37 | YES | |
| 38 | NS | NS |

Table 127 Labelled Standards for 6:2FTS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M6:2 FTS | NA |
| 2 | ISTD | |
| 3 | 6:2 FTS-13C2 | Yes |
| 4 | M2-6,2FTS | |
| 5 | 6:2FTS-13C2 | |
| 6 | Yes | |
| 7 | 13C2-6-2 FTS | |
| 8 | 6:2:FTS | |
| 9 | 13C2-6:2 FTS | NA |
| 10 | 13C2-6:2 FTS-Na | No |
| 11 | 13C2-6:2FTS | 13C4-PFOS |
| 12 | M2-6:2 FTS | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | 6:2FTS-13C2 | |
| 18 | | |
| 19 | 13C2-6:2 FTS | |
| 20 | 13C2-6:2 FTS | |
| 21 | 6:2 FTS-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | 13C2-6:2FTS | N/A |
| 25 | | |
| 27 | 13C2-6:2FTS | |
| 28 | Sodium 1H,1H,2H,2H-perfluoro1-[1,2-13C2]-octane sulfonate M2-6:2FTS | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C2-6:2 FTS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2,12C6 6:2-FTS | N/A |
| 35 | IS-6:2FTS | |
| 36 | M2-6:2 FTS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

Table 128 Labelled Standards for 10:2FTS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | | |
| 3 | 10:2 FTS 13C2-D4 | Yes |
| 4 | | |
| 5 | 10:2FTS-13C2 | |
| 6 | Yes | |
| 7 | 13C2-10-2 FTS | |
| 8 | 10:2:FTS | |
| 9 | 13C2-10:2 FTS | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M2-8:2 FTS | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | | |
| 16 | | |
| 17 | 10:2FTS-13C2 | |
| 18 | | |
| 19 | 13C2-8:2 FTS | |
| 20 | 13C2-8:2 FTS | |
| 21 | 10:2 FTS-13C2 | |
| 22 | Yes | |
| 23 | | |
| 24 | 13C2-8:2FTS | N/A |
| 25 | | |
| 27 | 13C2-10:2FTS | |
| 28 | | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C2-8:2 FTS | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2 10:2-FTS | N/A |
| 35 | IS-10:2FTS | |
| 36 | M2-10:2 FTS | 18O2 PFHxS |
| 37 | YES | |
| 38 | NS | NS |

Table 129 Labelled Standards for 8:2diPAP

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | ISTD | |
| 3 | 8:2 diPAP-13C4 | Yes |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | 8:2diPAP | |
| 9 | 13C2-8:2 diPAP | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M4-8:2diPAP | M2PFOA |
| 13 | Yes | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-8:2DiPAP | |
| 20 | 13C2-8:2diPAP | |
| 21 | 8:2 diPAP-13C4 | |
| 22 | | |
| 23 | | |
| 24 | 13C2-8:2diPAP | N/A |
| 25 | | |
| 27 | NT | |
| 28 | | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C2-8:2diPAP | |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | IS-8:2diPAP | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

Table 130 Labelled Standards for 6:2FTOH

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | NT | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | NT | NT |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | | |
| 20 | 13C2-6:2 FTOH | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | NA | N/A |
| 25 | | |
| 27 | 6:2FTOH-13C2-d2 | |
| 28 | | |
| 29 | INT_13C2-6:2FTOH (GC-NCI-MS) | |
| 30 | NS | NS |
| 31 | -- | |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | | |
| 36 | - | - |
| 37 | | |
| 38 | NS | NS |

Table 131 Labelled Standards for 3:3FTCA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFPeA | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 13C5-PFPeA | |
| 8 | | |
| 9 | 13C5-PFHxA | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M5PFHxA | M2PFOA |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFPeA | 13C5 -PFPeA |
| 20 | 13C5-PFHxA | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C4-PFHpA | N/A |
| 25 | | |
| 27 | 13C5-PFPeA | |
| 28 | | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C3-PFBS | |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C2-PFHxA | N/A |
| 35 | | |
| 36 | M5PFPeA | M2PFHxA |
| 37 | | |
| 38 | NS | NS |

Table 132 Labelled Standards for GenX

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3HFPO-DA | NA |
| 2 | ISTD | |
| 3 | | |
| 4 | M3HFPO-DA | |
| 5 | HFPO-DA-13C3 | |
| 6 | | |
| 7 | M3HFPO-DA | |
| 8 | GEN-X | |
| 9 | 13C3-GenX | NA |
| 10 | 13C3-HFPO-DA | No |
| 11 | 13C3-GenX | 13C5-PFNA |
| 12 | M3-HFPO-DA | MPFDA |
| 13 | Yes | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | HFPO-DA-13C3 | |
| 18 | | |
| 19 | 13C3-GenX | |
| 20 | M3HFPO-DA | |
| 21 | HFPO-DA-13C2 | |
| 22 | | |
| 23 | yes | |
| 24 | 13C3-HFPO-DA | N/A |
| 25 | | |
| 27 | 13C3-GenX | |
| 28 | 2 3 3 3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)(13C8)propanoic acid M3HFPO-DA | |
| 29 | INT_13C3-HFPO-DA | |
| 30 | NS | NS |
| 31 | 13C3-HFPO-DA | |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C312C3HF11O3 | N/A |
| 35 | IS-HFPO-DA | |
| 36 | M3HFPO-DA | M2PFHxA |
| 37 | | |
| 38 | NS | NS |

Table 133 Labelled Standards for PFMPA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | 13C4-PFBA | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M5PFHxA | M2PFOA |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFPeA | 13C5 -PFPeA |
| 20 | 13C4-PFBA | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C4-PFBA | N/A |
| 25 | | |
| 27 | 13C5-PFPeA | |
| 28 | | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C5-PFPeA | |
| 32 | | |
| 33 | NT | NO |
| 34 | 13C3-PFPeA | N/A |
| 35 | | |
| 36 | M5PFPeA | M2PFHxA |
| 37 | | |
| 38 | NS | NS |

Table 134 Labelled Standards for 11Cl-PF3OUdS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | PFUdA-13C2 | |
| 6 | | |
| 7 | M3HFPO-DA | |
| 8 | | |
| 9 | 13C5-PFNA | NA |
| 10 | NT | NT |
| 11 | 13C8-PFOS | - |
| 12 | M3-HFPO-DA | MPFDA |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | PFUdA-13C2 | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C8-PFOS | N/A |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | INT_13C2-PFDoDA | |
| 30 | NS | NS |
| 31 | 13C2-PFUnDA | |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | IS-PFOS | |
| 36 | M3HFPO-DA | M2PFHxA |
| 37 | | |
| 38 | NS | NS |

Table 135 Labelled Standards for PFEESA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | | |
| 9 | 13C3-PFBS | NA |
| 10 | NT | NT |
| 11 | - | - |
| 12 | M5PFHxA | M2PFOA |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| 18 | | |
| 19 | 13C2-PFHxA | 13C5 -PFPeA |
| 20 | 13C3-PFBS | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | 13C3-PFBS | N/A |
| 25 | | |
| 27 | 13C3-PFBS | |
| 28 | | |
| 29 | | |
| 30 | NS | NS |
| 31 | 13C3-PFBS | |
| 32 | | |
| 33 | NT | NO |
| 34 | 13C4-PFBA | N/A |
| 35 | | |
| 36 | M5PFHxA | M2PFHxA |
| 37 | | |
| 38 | NS | NS |

Table 136 Participant Methodology for Soil Samples– Additional Information

| Lab. Code | Sample | Additional Information |
|---|---|---|
| 1 | S1 | PFTeDA, 10:2 FTS and 11Cl-PF3OUdS not reportable (NR) due to poor recovery. Results in ug/kg |
| | S2 | PFTeDA, 10:2 FTS, GenX and 11Cl-PF3OUdS not reportable (NR) based on poor recovery. Results in ug/kg |
| 16 | S1 | PFOS result was higher than the range of our reporting, even after significant dilution of the extract |
| | S1 & S2 | Several analytes had significant amounts of branched isomers, but it is not our method or practice to report these isomers, except for PFHxS, PFOS, and PFOA |
| 19 | S1 | PFNS, PFDS and PFDoS - interference in peaks, quantified linear isomer only |
| 28 | S1 | PFECHS - Possible isobaric interference from unsaturated PFOS |
| 35 | S1 | L-PFOS and T-PFOS exceeds calibration range. Results to be considered indicative. |

### A6.2 Sample S3 Biosolids Methodology

Table 137 Participant Methodology – Sample Preparation and Extraction**

| Lab Code | S3 Sample Weight (g) | Labelled Std Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | Yes | 30 | NA | Alkaline Digestion | 1 | NaOH/MeOH | 90 | Yes | 50 | 45 | None | Not Applicable | No |
| 2 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 3 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 4 | 1.2 g | Yes | 30 min | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | 10 min for each step, 3 steps | Yes | | | Solid-Phase Extraction | 1%NH4-MeOH | Yes |
| 5 | 1.5 | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/MeOH | 90 | Yes | Room Temperature | Room Temperature | Filtration | Not Applicable | Yes |
| 6 | 5 | Yes | | | QuEChERS | | ACN:1%H2SO4 | 15 | No | | | Dilution and Filtration | | |
| 7 | 2 | Yes | 30 | | Solid-Liquid Extraction (vortexed and centrifuged) | | Basic ACN and Acetone | 30 | Yes | 45 | 30 | None | | No |
| 8 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 9 | 1g | Yes | 0.5 | | QuEChERS | 2 | ACN | 1440 | Yes | NA | NA | Filtration | Not Applicable | NA |
| 10 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 11 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 12 | 1.01 | Yes | 0 | 0 | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | KOH/MeOH | 120 | Yes | 40 | | Carbon SPE | KOH/MeOH | No |

| Lab Code | S3 Sample Weight (g) | Labelled Std Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | 0.5 - 2 g | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/MeOH | 120 | Yes | 30 | 120 | Solid-Phase Extraction | NH4OH/MeOH | Yes |
| 14 | 2 | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | No | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 15 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 16 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 17 | 1.5 | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | NH4OH/MeOH | 90 | Yes | Room Temperature | Room Temperature | Filtration | Not Applicable | Yes |
| 18 | | | | | | | | | | | | | | |
| 19 | 1 | Yes | 60 | | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | 99/1 methanol/ammonium hydroxide (v/v) | 2 x 20 min | Yes | 40 | | Liquid-liquid extraction with n-hexane | | No |
| 20 | 0.5 | Yes | | | Ion Pair Extraction with Solid-Liquid Extraction | | ACN/MeOH | 90 | Yes | | | Filtration | | |
| 21* | 1g | Yes | 1 hour | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | 2 hours | Yes | | | Filtration | | Yes |
| 22 | 5 | Yes | | | QuEChERS | | ACN:1%H2SO4 | 15 | No | | | Dilution and Filtration | | |

| Lab Code | S3 Sample Weight (g) | Labelled Std Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 23 | 2 | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | 2 | NH4OH/MeOH | 10 | Yes | | | | | Yes |
| 24 | | | | | | | | | | | | | | |
| 25 | 0.1044 | Yes | None | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH, 0.3% NH3 | | Yes | | | | | |
| 27 | 5 | Yes | | sample is dried and mixed. | ultrasonic bath, mechanical shaking | | MeOH | 90 | Yes | rt | | | Not Applicable | No |
| 28 | 1 | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | Extraction with MeOH/Ammonium hydroxide 99:1 | | | | | Solid-Phase Extraction | 10:89:1 IPA/ACN/Ammonium hydroxide | |
| 29 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 30 | | | | | | | | | | | | | | |
| 31 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 32 | | | | | | | | | | | | | | |
| 33 | 2 | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | Yes | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 34 | 2 | Yes | 10 | Homogenisation | Alkaline Digestion | N/A | Basic MeOH | 60 | Yes | 40 | 20 | Envirocarb | N/A | Yes |
| 35 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |
| 36 | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS | NS |

| Lab Code | S3 Sample Weight (g) | Labelled Std Added Before Extraction? | Equilibration Time for Labelled Std (min) | Other Sample Pretreatment | Extraction Technique | Staggered Extraction Steps | Extraction Solvent | Total Extraction Time (min) | Carbon Cleanup? | Extract Concentration Temperature (°C) | Extract Concentration Time (min) | Cleanup | Elution Solvent | Final pH adjustment? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 37 | 2 | Yes | 30 | None | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | No | Room Temp 22 °C | 30 | Solid-Phase Extraction | Basic ACN and Acetone | No |
| 38 | 2 | Yes | | | Solid-Liquid Extraction (vortexed and centrifuged) | | MeOH | 30 | Yes | | | None | | No |

*Additional Information in Table 138.

**Some responses may have been modified so that the participant cannot be identified.

Table 138 Participant Methodology – Extraction Additional Information

| Lab. Code | Extraction Additional Information |
|---|---|
| 21 | Active carbon cleanup |

Table 139 Participant Methodology – Instrumental Technique and Analysis

| Lab. Code | Instrument | Dilution Factor | Blank Correction? |
|---|---|---|---|
| 1 | LC-MSMS or LC-QQQ | No | No |
| 2 | NS | NS | NS |
| 3 | NS | NS | NS |
| 4 | LC-MSMS or LC-QQQ | No | No |
| 5 | LC-MSMS or LC-QQQ | | No |
| 6 | LC-Orbitrap | 8 | Yes |
| 7 | LC-MSMS or LC-QQQ | | No |
| 8 | NS | NS | NS |
| 9 | LC-MSMS or LC-QQQ | Neat and 5x | No |
| 10 | NS | NS | NS |
| 11 | NS | NS | NS |
| 12 | LC-MSMS or LC-QQQ | | No |
| 13 | LCMSMS | | No |
| 14 | LC-MSMS or LC-QQQ | No | No |
| 15 | NS | NS | NS |
| 16 | NS | NS | NS |
| 17 | LC-MSMS or LC-QQQ | | No |
| 18 | | | |
| 19 | LC-MSMS or LC-QQQ | No | No |
| 20 | LC-MSMS or LC-QQQ | No | No |
| 21 | LC-MSMS or LC-QQQ | | No |
| 22 | LC-Orbitrap | 8 | Yes |
| 23 | LC-MSMS or LC-QQQ | 2 | No |
| 24 | | | |
| 25 | LC-MSMS or LC-QQQ | No | No |
| 27 | LC-MSMS or LC-QQQ | | No |

| Lab. Code | Instrument | Dilution Factor | Blank Correction? |
|---|---|---|---|
| 28 | LC-Orbitrap | x1 and x10 | No |
| 29 | NS | NS | NS |
| 30 | | | |
| 31 | NS | NS | NS |
| 32 | | | |
| 33 | LC-MSMS or LC-QQQ | Yes, 10x | No |
| 34 | LC-MSMS or LC-QQQ | 10 | NA |
| 35 | NS | NS | NS |
| 36 | NS | NS | NS |
| 37 | LC-MSMS or LC-QQQ | No | No |
| 38 | LC-MSMS or LC-QQQ | | Yes |

Table 140 Participant Methodology – Labelled Standards

| Lab. Code | Labelled Standard Source | Secondary Source Used to Check Standard? | Recovery Correction? | Standard Method Used? |
|---|---|---|---|---|
| 1 | Wellington | No | Yes | No |
| 2 | NS | NS | NS | NS |
| 3 | NS | NS | NS | NS |
| 4 | | | | |
| 5 | Wellington | Yes | Yes | |
| 6 | Wellington Laboratories | | Yes | |
| 7 | Wellington | Yes | No | No |
| 8 | NS | NS | NS | NS |
| 9 | Wellington | Yes | Yes | In-house |
| 10 | NS | NS | NS | NS |

| Lab. Code | Labelled Standard Source | Secondary Source Used to Check Standard? | Recovery Correction? | Standard Method Used? |
|---|---|---|---|---|
| 11 | NS | NS | NS | NS |
| 12 | Wellington Laboratories | | Yes | USEPA 537 |
| 13 | | | | |
| 14 | Wellington | | Yes | |
| 15 | NS | NS | NS | NS |
| 16 | NS | NS | NS | NS |
| 17 | Wellington | Yes | Yes | |
| 18 | | | | |
| 19 | Wellington | No | Yes | Isotopic Dilution |
| 20 | Wellington Standards | Yes | Yes | |
| 21 | Wellington Laboratories | | No | EPA 1663 |
| 22 | Wellington Laboratories | | Yes | |
| 23 | Wellington Labs | yes | No | |
| 24 | | | | |
| 25 | Wellington Laboratory | No | Yes | USEPA 1633 |
| 27 | Greyhound, Wellington, TLC, LGC | | No | DIN 38414-14 |
| 28 | Wellington | | Yes | |
| 29 | NS | NS | NS | NS |
| 30 | | | | |
| 31 | NS | NS | NS | NS |
| 32 | | | | |
| 33 | Wellington | YES | Yes | Extracted Isotope Dilution |
| 34 | Wellington | | Yes | No. Inhouse |

| Lab. Code | Labelled Standard Source | Secondary Source Used to Check Standard? | Recovery Correction? | Standard Method Used? |
|---|---|---|---|---|
| 35 | NS | NS | NS | NS |
| 36 | NS | NS | NS | NS |
| 37 | | | | |
| 38 | CIL | yes | Yes | |

Table 141 Labelled Standards for PFBA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M4PFBA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | MPFBA | |
| 5 | PFBA-13C4 | |
| 6 | Yes | |
| 7 | 13C4-PFBA | |
| 8 | NS | NS |
| 9 | 13C4-PFBA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | MPFBA | M3PFBA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFBA-13C4 | |
| 18 | | |
| 19 | 13C4-PFBA | 13C3-PFBA |
| 20 | 13C4-PFBA | |
| 21 | PFBA-13C4; PFBA-13C3 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C4-PFBA | |
| 28 | Perfluoro-n-[13C4]butanoic acid MPFBA | Perfluoro-n-[2,3,4-13C4]butanoic acid M3PFBA |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFBA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 142 Labelled Standards for PFPeA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFPeA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M5PFPeA | |
| 5 | PFPeA-13C3 | |
| 6 | Yes | |
| 7 | 13C5-PFPeA | |
| 8 | NS | NS |
| 9 | 13C5-PFPeA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M5PFPeA | M3PFBA |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFPeA-13C3 | |
| 18 | | |
| 19 | 13C4-PFPeA | 13C5 -PFPeA |
| 20 | 13C5-PFPeA | |
| 21 | PFPeA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C5-PFPeA | |
| 28 | Perfluoro-n-[13C5]pentanoic acid M5PFPeA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C3-PFPeA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

Table 143 Labelled Standards for PFHxA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M5PFHxA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M5PFHxA | |
| 5 | PFHxA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFHxA | |
| 8 | NS | NS |
| 9 | 13C5-PFHxA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M5PFHxA | M3PFBA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFHxA-13C2 | |
| 18 | | |
| 19 | 13C2-PFHxA | 13C5 -PFPeA |
| 20 | 13C5-PFHxA | |
| 21 | PFHxA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C5-PFHxA | |
| 28 | Perfluoro-n-[1,2,3,4,6-13C5]hexanoic acid M5PFHxA | Perfluoro-n-[1,2-13C5]hexanoic acid MPFHxA |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFHxA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

## Table 144 Labelled Standards for PFHpA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFHpA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M4PFHpA | |
| 5 | PFHpA-13C4 | |
| 6 | Yes | |
| 7 | 13C4-PFHpA | |
| 8 | NS | NS |
| 9 | 13C4-PFHpA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M4PFHpA | M3PFBA |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFHpA-13C4 | |
| 18 | | |
| 19 | 13C3-PFHpA | 13C8-PFOA |
| 20 | 13C4-PFHpA | |
| 21 | PFHpA-13C4 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C4-PFHpA | |
| 28 | Perfluoro-n-[1,2,3,4-13C4]heptanoic acid M4PFHpA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFHpA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

## Table 145 Labelled Standards for PFOA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M8PFOA | |
| 5 | PFOA-13C4 | PFOA-13C2 |
| 6 | Yes | |
| 7 | 13C8-PFOA | |
| 8 | NS | NS |
| 9 | 13C4-PFOA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOA | M2PFOA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFOA-13C4 | PFOA-13C2 |
| 18 | | |
| 19 | 13C4-PFOA | 13C8-PFOA |
| 20 | 13C8-PFOA | |
| 21 | PFOA-13C4; PFOA-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C4-PFOA | |
| 28 | Perfluoro-n-[13C8]octanoic acid M8PFOA | Perfluoro-n-[1,2,3,4-13C8]octanoic acid MPFOA |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

## Table 146 Labelled Standards for PFNA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M9PFNA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M9PFNA | |
| 5 | PFNA-13C5 | |
| 6 | Yes | |
| 7 | 13C5-PFNA | |
| 8 | NS | NS |
| 9 | 13C5-PFNA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M9PFNA | M2PFOA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFNA-13C5 | |
| 18 | | |
| 19 | 13C5-PFNA | 13C8-PFOA |
| 20 | 13C5-PFNA | |
| 21 | PFNA-13C9; PFNA-13C5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C5-PFNA | |
| 28 | Perfluoro-n-[13C9]nonanoic acid M9PFNA | Perfluoro-n-[1,2,3,4,5-13C9]nonanoic acid MPFNA |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C5-PFNA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

## Table 147 Labelled Standards for PFDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M6PFDA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M6PFDA | |
| 5 | PFDA-13C2 | |
| 6 | Yes | |
| 7 | 13C6-PFDA | |
| 8 | NS | NS |
| 9 | 13C6-PFDA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M6PFDA | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFDA-13C2 | |
| 18 | | |
| 19 | 13C2-PFDA | 13C8-PFOA |
| 20 | 13C6-PFDA | |
| 21 | PFDA-13C6; PFDA-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C6-PFDA | |
| 28 | Perfluoro-n-[1,2,3,4,6-13C6]decanoic acid M6PFDA | Perfluoro-n-[1,2-13C6]decanoic acid MPFDA |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFDA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

## Table 148 Labelled Standards for PFDoA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | MPFDoA | |
| 5 | PFDoA-13C2 | |
| 6 | | |
| 7 | 13C2-PFDoA | |
| 8 | NS | NS |
| 9 | 13C2-PFDoDA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | MPFDoA | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFDoA-13C2 | |
| 18 | | |
| 19 | 13C2-PFDoA | 13C8-PFOA |
| 20 | 13C2-PFDoDA | |
| 21 | PFDoA-13C2 | |
| 22 | | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | Perfluoro-n-[1,2 13C2]dodecanoic acid MPFDoA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFDoDA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

## Table 149 Labelled Standards for PFTrDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | PFDoA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFTeDA | |
| 8 | NS | NS |
| 9 | 13C2-PFDoDA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | MPFDoA | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFDoA-13C2 | |
| 18 | | |
| 19 | 13C2-PFDoA | 13C8-PFOA |
| 20 | 13C2-PFTeDA | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C2-PFTrDA | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C2-PFTeDA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

## Table 150 Labelled Standards for PFTeDA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFTeDA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M2PFTeDA | |
| 5 | PFTeDA-13C2 | |
| 6 | Yes | |
| 7 | 13C2-PFTeDA | |
| 8 | NS | NS |
| 9 | 13C2-PFTeDA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M2PFTeDA | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFTeDA-13C2 | |
| 18 | | |
| 19 | 13C2-PFTeDA | 13C8-PFOA |
| 20 | 13C2-PFTeDA | |
| 21 | PFTeDA-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C2-PFTeDA | |
| 28 | Perfluoro-n-[1,2 13C2]tetradecanoic acid M2PFTeDA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2-PFTeDA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

## Table 151 Labelled Standards for PFBS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFBS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M3PFBS | |
| 5 | PFBS-1C3 | |
| 6 | Yes | |
| 7 | 13C3-PFBS | |
| 8 | NS | NS |
| 9 | 13C3-PFBS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3PFBS | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFBS-1C3 | |
| 18 | | |
| 19 | 13C3-PFBS | 13C3-PFHxS |
| 20 | 13C3-PFBS | |
| 21 | PFBS-13C3 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C3-PFBS | |
| 28 | Sodium perfluoro-1-[2,3,4 13C3] butanesulfonate M3PFBS | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C3-PFBS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

## Table 152 Labelled Standards for PFHxS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M3PFHxS | |
| 5 | PFHxS-18O2 | PFHxS-13C3 |
| 6 | Yes | |
| 7 | 18O2-PFHxS | |
| 8 | NS | NS |
| 9 | 16O2-PFHxS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3PFHxS | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFHxS-18O2 | PFHxS-13C3 |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | 16O2-PFHxS | |
| 21 | PFHxS-13C3; PFHxS-18O2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | Sodium perfluoro-1-[1,2,3 13C3] hexanesulfonate M3PFHxS | Sodium perfluoro-1-hexane (1O2) sulfonate MPFHxS |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 18O2-PFHxS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

Table 153 Labelled Standards for PFHxS_L

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 18O2-PFHxS | |
| 8 | NS | NS |
| 9 | NT | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3PFHxS | MPFDA |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | Not applicable | |
| 21 | PFHxS-13C3; PFHxS-18O2 | |
| 22 | | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 18O2-PFHxS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

Table 154 Labelled Standards for PFHpS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3PFHxS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | PFOS-13C4 | |
| 6 | Yes | |
| 7 | 18O2-PFHxS | |
| 8 | NS | NS |
| 9 | 16O2-PFHxS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3PFHxS | MPFDA |
| 13 | | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFOS-13C4 | |
| 18 | | |
| 19 | 18O2-PFHxS | 13C3-PFHxS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 18O2-PFHxS | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 155 Labelled Standards for PFOS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M8PFOS | |
| 5 | PFOS-13C4 | PFOS-13C8 |
| 6 | Yes | |
| 7 | 13C8-PFOS | |
| 8 | NS | NS |
| 9 | 13C8-PFOS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOS | MPFOS |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFOS-13C4 | PFOS-13C8 |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C4-PFOS | |
| 21 | PFOS-13C8; PFOS-13C4 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | Sodium perfluoro-1-[ 13C8] ocatanesulfonate M8PFOS | Sodium perfluoro-1-[ 1,2,3,4-13C4] ocatanesulfonate MPFOS |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 156 Labelled Standards for PFOS_L

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 13C8-PFOS | |
| 8 | NS | NS |
| 9 | NT | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOS | MPFOS |
| 13 | Yes | Yes |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | PFOS-13C8; PFOS-13C4 | |
| 22 | | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 157 Labelled Standards for PFNS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | Yes | |
| 7 | 13C8-PFOS | |
| 8 | NS | NS |
| 9 | 13C8-PFOS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 158 Labelled Standards for PFDS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M8PFOS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | PFOS-13C4 | |
| 6 | Yes | |
| 7 | 13C8-PFOS | |
| 8 | NS | NS |
| 9 | 13C8-PFOS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFOS-13C4 | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 159 Labelled Standards for PFDoS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | Yes | |
| 7 | NA | |
| 8 | NS | NS |
| 9 | 13C2-PFTeDA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8PFOS | MPFOS |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C2-PFTeDA | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C2-PFDoA | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 160 Labelled Standards for PFOSA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFOSA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M8FOSA | |
| 5 | FOSA-13C8 | |
| 6 | Yes | |
| 7 | 13C8-FOSA | |
| 8 | NS | NS |
| 9 | 13C8-FOSA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M8FOSA-I | MPFDA |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | FOSA-13C8 | |
| 18 | | |
| 19 | 13C8-FOSA | |
| 20 | 13C8-FOSA | |
| 21 | FOSA-13C8 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C8-PFOSA | |
| 28 | N-methyl-d3-perfluoro-1-octancesulfonamide M8FOSA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C8-FOSA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 161 Labelled Standards for EtFOSAA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | d5-NEtFOSAA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | d5-N-EtFOSAA | |
| 5 | EtFOSAA-D5 | |
| 6 | Yes | |
| 7 | d5-N-EtFOSAA | |
| 8 | NS | NS |
| 9 | d5-EtFOSAA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | d5-N-EtFOSAA | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | EtFOSAA-D5 | |
| 18 | | |
| 19 | D5-N-Et FOSAA | |
| 20 | d5-EtFOSAA | |
| 21 | N-EtFOSAA-2H5 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | d5-EtFOSAA | |
| 28 | N-ethyl-d5-perfluoro-1-octanesulfonamidoacetic acid d5-N-EtFOSAA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | D5-Et-FOSAA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | no | no |

Table 162 Labelled Standards for 6:2FTS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M6:2 FTS | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M2-6,2FTS | |
| 5 | 6:2FTS-13C2 | |
| 6 | Yes | |
| 7 | 13C2-6-2 FTS | |
| 8 | NS | NS |
| 9 | 13C2-6:2 FTS | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M2-6:2 FTS | MPFOS |
| 13 | Yes | |
| 14 | YES | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | 6:2FTS-13C2 | |
| 18 | | |
| 19 | 13C2-6:2 FTS | |
| 20 | 13C2-6:2 FTS | |
| 21 | 6:2 FTS-13C2 | |
| 22 | Yes | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C2-6:2FTS | |
| 28 | Sodium 1H,1H,2H,2H-perfluoro1-[1,2-13C2]-octane sulfonate M2-6:2FTS | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C2,12C6 6:2-FTS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | YES | |
| 38 | yes | no |

Table 163 Labelled Standards for 6:2diPAP

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | NS | NS |
| 9 | 13C2-6:2 diPAP | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M4-6:2diPAP | M2PFOA |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C4-6:2DiPAP | |
| 20 | 13C2-6:2diPAP | |
| 21 | 6:2 diPAP-13C4 | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C4-6:2 diPAP | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 164 Labelled Standards for 8:2diPAP

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | NT | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | NA | |
| 8 | NS | NS |
| 9 | 13C2-8:2 diPAP | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M4-8:2diPAP | M2PFOA |
| 13 | Yes | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C4-8:2DiPAP | |
| 20 | 13C2-8:2diPAP | |
| 21 | 8:2 diPAP-13C4 | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 3C4-8:2 diPAP | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NT | NO |
| 34 | NT | NT |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 165 Labelled Standards for 5:3FTCA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFHpA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | | |
| 6 | | |
| 7 | 13C2-PFHxA | |
| 8 | NS | NS |
| 9 | 13C4-PFOA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M5PFHxA | M2PFOA |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | | |
| 18 | | |
| 19 | 13C2-PFHxA | 13C5 -PFPeA |
| 20 | 13C5-PFHxA | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C5-PFPeA | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 166 Labelled Standards for GenX

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | M3HFPO-DA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | M3HFPO-DA | |
| 5 | HFPO-DA-13C3 | |
| 6 | | |
| 7 | M3HFPO-DA | |
| 8 | NS | NS |
| 9 | 13C3-GenX | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3-HFPO-DA | MPFDA |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | HFPO-DA-13C3 | |
| 18 | | |
| 19 | 13C3-GenX | |
| 20 | M3HFPO-DA | |
| 21 | HFPO-DA-13C2 | |
| 22 | | |
| 23 | yes | |
| 24 | | |
| 25 | | |
| 27 | 13C3-GenX | |
| 28 | 2 3 3 3-tetrafluoro-2-(1,1,2,2,3,3,3-heptafluoropropoxy)(13C8)propanoic acid M3HFPO-DA | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | YES | NO |
| 34 | 13C312C3HF11O3 | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 167 Labelled Standards for ADONA

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFHpA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | PFHxS-18O2 | |
| 6 | Yes | |
| 7 | M3HFPO-DA | |
| 8 | NS | NS |
| 9 | 13C4-PFHpA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3-HFPO-DA | MPFDA |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFHxS-18O2 | |
| 18 | | |
| 19 | 13C3-PFHpA | 13C8-PFOA |
| 20 | 13C4-PFHpA | |
| 21 | | |
| 22 | Yes | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C4-PFHpA | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C3-PFPeA | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 168 Labelled Standards for 11Cl-PF3OUdS

| Lab. Code | Before Extraction | Before Instrument Analysis |
|---|---|---|
| 1 | MPFDoDA | NA |
| 2 | NS | NS |
| 3 | NS | NS |
| 4 | | |
| 5 | PFUdA-13C2 | |
| 6 | | |
| 7 | M3HFPO-DA | |
| 8 | NS | NS |
| 9 | 13C5-PFNA | NA |
| 10 | NS | NS |
| 11 | NS | NS |
| 12 | M3-HFPO-DA | MPFDA |
| 13 | | |
| 14 | | |
| 15 | NS | NS |
| 16 | NS | NS |
| 17 | PFUdA-13C2 | |
| 18 | | |
| 19 | 13C4-PFOS | 13C8-PFOS |
| 20 | 13C8-PFOS | |
| 21 | | |
| 22 | | |
| 23 | | |
| 24 | | |
| 25 | | |
| 27 | 13C8-PFOS | |
| 28 | | |
| 29 | NS | NS |
| 30 | | |
| 31 | NS | NS |
| 32 | | |
| 33 | NO | NO |
| 34 | 13C4-PFOS | N/A |
| 35 | NS | NS |
| 36 | NS | NS |
| 37 | | |
| 38 | no | no |

Table 169 Participant Methodology for Biosolids Samples – Additional Information

| Lab. Code | Sample | Additional Information |
|---|---|---|
| 1 | S3 | PFTeDA, 4:2FTS, 6:2FTS, 8:2FTS, 10:2FTS, and 11Cl-PF3OUdS not reportable (NR) based on poor recovery. Results in ug/kg |
| 16 | S3 | Several analytes had significant amounts of branched isomers, but it is not our method or practice to report these isomers, except for PFHxS, PFOS, and PFOA |
| 19 | S3 | NR - No result reported due to poor recovery (less than 10%) of the internal standard. 8:2 diPAP not reported in this sample due to unusually high recovery (more than 300%) |

## APPENDIX 7 – ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| 10:2FTS | 1H, 1H, 2H, 2H-perfluorododecane sulfonate |
| 11Cl-PF3OUdS | 11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid |
| 3:3FTCA | 2H, 2H, 3H, 3H-perfluorohexanoic acid |
| 4:2FTS | 1H, 1H, 2H, 2H-perfluorohexane sulfonate |
| 5:3FTCA | 2H, 2H, 3H, 3H-perfluorooctanoic acid |
| 6:2FTS | 1H, 1H, 2H, 2H-perfluorooctane sulfonate |
| 7:3FTCA | 2H, 2H, 3H, 3H-perfluorodecanoic acid |
| 8:2diPAP | Fluorotelomer phosphate diester |
| 8:2FTS | 1H, 1H, 2H, 2H-perfluorodecane sulfonate |
| 9Cl-PF3ONS | 9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid |
| ACN | Acetonitrile |
| ACN/Base | Base modified acetonitrile |
| ACN/MeOH | Base modified acetonitrile |
| ADONA | Ammonium 4,8-dioxa-3H-perfluorononanoate |
| AQA | Analytical and Quality Assurance |
| ASTM | American Society for Testing and Materials |
| AV | Assigned Value |
| CITAC | Co-Operation on International Traceability in Analytical Chemistry |
| CRM | Certified Reference Material |
| CV | Coefficient of Variation |
| EPA | Environment Protection Authority |
| EtFOSA | N-Ethyl perfluorooctane sulfonamide |
| EtFOSAA | N-Ethyl perfluorooctane sulfonamido acetic acid |
| EtFOSE | N-Ethyl perfluorooctane sulfonamidoethanol |
| GenX | Ammonium 2,3,3,3-tetrafluoro-2-(heptafluoropropoxy) propanoate |
| GUM | Guide for Uncertainty Measurement |
| HFPO-DA | Hexafluoropropylene Oxide-Dimer Acid |
| HV | Homogeneity Value |
| ISO | International Standards Organisation |
| IS | Internal Standard |
| KOH | Potassium Hydroxide |
| LC | Liquid Chromatography |
| LC-MSMS | Liquid Chromatography with Tandem Mass Spectrometry |
| LOR | Limit of Reporting |
| Max | Maximum value in a set of results |
| Md | Median |
| MeFOSA | N-Methyl perfluorooctane sulfonamide |
| MeFOSAA | N-Methyl perfluorooctane sulfonamidoacetic acid |

| | |
|---|---|
| MeFOSE | N-Methyl perfluorooctane sulfonamidoethanol |
| MeOH | Methanol |
| MeOH/Base | Base modified methanol |
| Min | Minimum value in a set of results |
| MS | Mass Spectrometry |
| MU | Measurement Uncertainty |
| NATA | National Association of Testing Authorities, Australia |
| NFDHA | Nonafluoro-3,6-dioxaheptanoic acid |
| NH4C2H3O2 | Ammonium acetate |
| NH4OH | Ammonium hydroxide |
| NMIA | National Measurement Institute Australia |
| NR | Not Reported |
| NS | Not Supplied |
| NT | Not Tested |
| PCV | Performance Coefficient of Variation |
| PFAA | Perfluoroalkyl acids |
| PFAS | Per- and poly fluorinated alkyl substances |
| PFBA | Perfluoro-n-butanoic acid |
| PFBS | Potassium perfluoro-1-butanesulfonate |
| PFCA | Perfluorinated carboxylic acids |
| PFDA | Perfluoro-n-decanoic acid |
| PFDoA | Perfluorododecanoic acid |
| PFDoS | Perfluorododecane sulfonate |
| PFDS | Perfluorodecane sulfonate |
| PFECA | Perfluoroalkyl ether carboxylic acid |
| PFECHS | Perfluoroethylcyclohexane sulfonate |
| PFEESA | Perfluoro(2-ethoxyethane)sulfonic acid |
| PFESA | Polyfluorinated ether sulfonic acid |
| PFHpA | Perfluoro-n-heptanoic acid |
| PFHpS | Perfluoroheptane sulfonate |
| PFHxA | Perfluoro-n-hexanoic acid |
| PFHxDA | Perfluorohexadecanoic acid |
| PFHxS | Potassium perfluorohexanesulfonate |
| PFHxS_L | Potassium perfluorohexanesulfonate linear |
| PFMBA | Perfluoro-4-methoxybutanoic acid |
| PFMPA | Perfluoro-3-methoxypropanoic acid |
| PFNA | Perfluoro-n-nonanoic acid |
| PFNS | Perfluorononane sulfonate |
| PFOA | Perfluorooctanoic acid |
| PFODA | Perfluorooctadecanoic acid |

| | |
|---|---|
| PFOS | Perfluorooctane sulfonate |
| PFOS_L | Perfluorooctane sulfonate linear |
| PFOSA | Perfluoro-1-octanesulfonamide |
| PFPeA | Perfluoro-n-pentanoic acid |
| PFPeS | Perfluoropentane sulfonate |
| PFSA | Perfluorosulfonic acid |
| PFTeDA | Perfluorotetradecanoic acid |
| PFTrDA | Perfluorotridecanoic acid |
| PFTrDS | Perfluorotridecane sulfonate |
| PFUdA | Perfluoroundecanoic acid |
| PFUdS | Perfluoroundecane sulfonate |
| PT | Proficiency Test |
| QC | Quality Control |
| QQQ | Triple Quadrupole (mass spectrometry) |
| QuEChERS | Quick, Easy, Cheap, Effective, Rugged and Safe extraction method |
| RA | Robust Average |
| RM | Reference Material |
| Robust CV | Robust Coefficient of Variation |
| Robust SD | Robust Standard Deviation |
| RT | Room Temperature |
| SD | Standard Deviation |
| SDPA | Standard Deviation for Proficiency Assessment |
| SLE | Solid-Liquid Extraction |
| SPE | Solid Phase Extraction |
| SS | Spiked Samples |
| SV | Spiked or formulated concentration of a PT sample (Spiked Value) |
| USEPA | United States Environmental Protection Agency |

**END OF REPORT**