Australian Government
Department of Industry, Science and Resources
National Measurement Institute

Proficiency Test Final Report AQA 25-05 Methamphetamine/MDMA in Wipes

October 2025

ACKNOWLEDGMENTS

This study was conducted by the National Measurement Institute Australia (NMIA). Support funding was provided by the Australian Government Department of Industry, Science and Resources.

I would like to thank the management and staff of the participating laboratories for supporting the study. It is only through widespread participation that we can provide an effective service to laboratories.

The assistance of the following NMIA staff members in the planning, conduct and reporting of the study is acknowledged.

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NATA

WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17043

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SUMMARY

This report presents the results of proficiency study AQA 25-05 Methamphetamine/MDMA in Wipes. Sixteen laboratories enrolled to participate, and all participants submitted results.

Four test samples were prepared by spiking wipes with varying amounts of methamphetamine (Samples S1, S2 and S3) and 3,4-methylenedioxymethamphetamine (MDMA) (Sample S4).

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

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 this study were assessed against the aims as follows:

- *Assess participants' capabilities to measure methamphetamine and MDMA in wipes;*

Participants' were assessed using both z-score and E_n-score.

Of 59 z-scores, 57 (97%) returned a z-score of $|z| \leq 2.0$, indicating an acceptable performance.

Of 59 E_n-scores, 44 (75%) returned an E_n-score of $|E_n| < 1.0$, indicating agreement of the participant's result with the assigned value within their respective expanded uncertainties.

Laboratories **3**, **7**, **12**, **13** and **15** returned acceptable z-scores and E_n-scores for all scored analytes in the study.

- *Evaluate participants' methods for the measurement of methamphetamine and MDMA in wipes;*

Participants used a variety of methods based on the NIOSH 9111 method.

Most methodologies reported by participants produced results in good agreement with each other.

- *Develop the practical application of measurement uncertainty, and provide participants with information that will be useful in assessing their uncertainty evaluations.*

Of 59 numeric results, 55 (93%) were reported with an associated measurement uncertainty.

Participants used a variety of methods to evaluate their measurement uncertainty. These methods produced relative uncertainties ranging from 2.4% to 50%.

- *Produce materials that can be used in method validation and as control samples.*

The test samples produced for this study are homogeneous and are well characterised. Surplus of these samples is available for purchase and can be used for quality control and for method validation purposes.

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:

- pesticide residues in soil, water, fruit, vegetables and herbs;
- hydrocarbons, phenols and volatile organic compounds in soil and water;
- inorganic analytes in soil, water, filters, food and pharmaceuticals;
- per- and polyfluoroalkyl substances in soil, biosolid, water, biota and food;
- controlled drug assay, drugs in wipes, and clandestine laboratory; and
- allergens in food.

1.2 Study Background

Clandestine laboratories ('clan labs') are places where illegal drugs have been manufactured. During the drug manufacturing process, toxic gases and aerosols are produced, which may be absorbed by the surroundings and may remain for many years. Field test kits are used to check the extent of contamination in the premises, and samples may be taken from non-porous surfaces using wipes. This PT scheme was developed to enable laboratories to assess their ability to measure controlled substances in wipes at levels specified in the Clandestine Drug Laboratory Remediation Guidelines 2011.[2]

1.3 Study Aims

The aims of the study were to:

- assess participants' capabilities to measure methamphetamine and 3,4-methylenedioxymethamphetamine (MDMA) in wipes;
- evaluate participants' methods for the measurement of methamphetamine and MDMA in wipes;
- develop the practical application of measurement uncertainty, and provide participants with information that will be useful in assessing their uncertainty evaluations; and
- produce materials that can be used in method validation and as control samples.

The choice of test method was left to the participating laboratories.

1.4 Study Conduct

The conduct of NMIA PT studies is described in the NMIA Study Protocol for Proficiency Testing.[3] The statistical methods used are described in the NMIA Chemical Proficiency Testing Statistical Manual.[4] These documents have been prepared with reference to ISO/IEC 17043 and The International Harmonized Protocol for the Proficiency Testing of Analytical Chemistry Laboratories.[1,5] NMIA is accredited by the National Association of Testing Authorities, Australia (NATA) to ISO/IEC 17043 as a provider of PT schemes.[1] This study is within the scope of NMIA's accreditation.

2 STUDY INFORMATION

2.1 Study Timetable

The timetable of the study was:

Invitations sent	17/02/2025
Samples sent	05/05/2025
Results due	08/08/2025
Interim Report	14/08/2025
Preliminary Report	19/08/2025

The timeline of this PT study was extended due to delays experienced by some participants in obtaining their permits.

2.2 Participation and Laboratory Code

Sixteen laboratories enrolled to participate in this study. Each participant was randomly assigned a confidential laboratory code for this study. All participants submitted results.

2.3 Test Material Preparation and Specification

Four test samples were prepared, each containing one wipe. A methamphetamine spiking solution was prepared by dissolving a known mass of methamphetamine hydrochloride (approximately 78.5% base (m/m) supplied by NMIA Chemical Reference Materials) in methanol. A MDMA spiking solution was prepared by dissolving a known mass of MDMA hydrochloride (approximately 84% base (m/m) supplied by NMIA Chemical Reference Materials) in methanol.

Large Liv-Wipe alcohol wipes were spiked with methamphetamine or MDMA spiking solution, and the solvent was allowed to evaporate off. Each wipe was placed in an amber glass jar, labelled, shrink-wrapped, and stored refrigerated before sample dispatch.

Sample S1 was prepared to contain 0.347 µg methamphetamine base/wipe.

Sample S2 was prepared to contain 1.28 µg methamphetamine base/wipe.

Sample S3 was prepared to contain 2.19 µg methamphetamine base/wipe.

Sample S4 was prepared to contain 12.4 µg MDMA base/wipe.

2.4 Homogeneity and Stability of Test Materials

No homogeneity or stability testing was conducted for this PT study's samples. The process used to prepare, store and dispatch the test samples has been demonstrated to produce sufficiently homogeneous and stable samples in previous NMIA PT studies.

To assess possible instability, the assigned values were compared to the spiked values. The assigned values were 98% to 108% of the spiked values, providing good support for the stability of the test materials. Participants' results also gave no reason to question the homogeneity or stability of the samples (Appendix 1).

2.5 Sample Storage, Dispatch and Receipt

The test samples were stored at 4°C after preparation and prior to dispatch. Samples were packed with ice blanket cells or cooler bricks and sent by courier on 5 May 2025. The following items were packaged with the samples:

- a letter which included a description of the test samples and instructions for participants; and

- a form for participants to return to confirm the receipt and condition of the samples.

An Excel spreadsheet for the electronic reporting of results was emailed to participants.

2.6 Instructions to Participants

Participants were instructed as follows:

- If analyses cannot be commenced on the day of receipt, please store the samples refrigerated.
- Quantitatively analyse each wipe for the amount of methamphetamine or MDMA using your routine test method.
- For each of Samples S1, S2 and S3, report a single result in units of µg methamphetamine as base/wipe. For Sample S4, report a single result in units of µg MDMA as base/wipe. Results should be expressed as if reporting to a client (i.e. corrected for recovery or not, according to your standard procedure). This figure will be used in all statistical analysis in the study report.
- For each result also report an evaluation of your expanded uncertainty as µg methamphetamine or MDMA as base/wipe.
- No limit of reporting has been set for this study. Report results as you would report to a client, applying the limit of reporting of the method used for analysis.
- You do not need to test all samples. Please report any sample not tested as NT.
- Give brief details of your methodology and basis of uncertainty evaluation as requested by the results sheet emailed to you.
- Please return your completed results sheet by 16 June 2025 by email to proficiency@measurement.gov.au.

The results due date was later extended to 8 August 2025 due to delays experienced by some participants in obtaining their permits.

2.7 Interim Report and Preliminary Report

An Interim Report was emailed to all participants on 14 August 2025.

A Preliminary Report was emailed to all participants on 19 August 2025. This report included a summary of the results reported by participants, assigned values, performance coefficient of variations, z-scores and E_n-scores for each analyte in this study. No data from the Preliminary Report has been changed in the present Final Report.

3 PARTICIPANT LABORATORY INFORMATION

3.1 Participants' Test Methods

Participants were requested to provide information about their test methods. Responses received are presented in Tables 1 to 3.Some responses may be modified so that the participant cannot be identified.

Table 1 Summary of Participants' Test Methods for Methamphetamine in Wipes

Lab. Code	Desorption Solution	Sample Treatment	Filtration	Technique	Detector	Method Reference
1	0.1M Sulfuric Acid	1hr on Rotary Mixer	No Filtration	HPLC	MS/MS	In House
2	0.2 N sulphuric acid	1 hour on rotary mixer, pH adjustment, derivatization		GC	MS	In House
3	0.1M sulphuric acid	1 hr on rotary mixer, pH adjustment	None	HPLC	MS/MS	NIOSH 9111
4*	0.1M sulfuric acid	30 minutes on rotary mixer	0.45 µm Acrodisc filter	HPLC	MS/MS	In-house developed method
5	0.1M sulfuric acid	30min on orbital shaker	Nil	UPLC	MS/MS	NIOSH 9111
6*	Methanol:pH2 MilliQ(v/v 1:1)	sonications and extraction	0.2µm RC filter	UPLC	MS/MS	modified NIOSH 9111
7*	0.1 M sulfuric acid in UHP water	Samples shaken,1hr tumbled end over end and 20 min sonication	0.2 µm filter	HPLC	MS/MS	based on NIOSH 9111
8	0.1 M sulfuric acid	1 hr on linear shaker	N/A	HPLC	MS/MS	NIOSH 9111 Modified
9*	0.1M Sulfuric Acid	1 hr on rotary mixer, pH adjustment	0.22um Nylon Filter	UPLC	MS/MS	NIOSH 9111
10	0.1 M sulfuric acid	1 Hour Rotary Mixer - Inject	Nil.	HPLC	MS/MS	In-House Method
11*	0.1 M sulfuric acid	1 hr on rotary mixer	Agilent PES 0.45 um, 25 mm	HPLC	MS	Based on NIOSH 9111
12	0.1 M sulfuric acid	1 hr on rotary mixer	No Filtration	HPLC	MS/MS	In house
13	0.1M sulphuric acid	1 hr on rotary mixer, pH adjustment	None	HPLC	MS/MS	NIOSH 9111
14*	Methanol		0.45 µm PVDF	HPLC	DAD	In House
15	0.1 M sulfuric acid	1 hr on rotary mixer	No Filtration	HPLC	MS/MS	based on NIOSH 9111
16*	0.1 M sulfuric acid	1 hr on rotary mixer, pH adjustment	0.45 RC filter	HPLC	MS/MS	in-house based in NIOSH 9111

*Additional information in Table 3.

Table 2 Summary of Participants' Test Methods for MDMA in Wipes

Lab. Code	Desorption Solution	Sample Treatment	Filtration	Technique	Detector	Method Reference
1	0.1M Sulfuric Acid	1hr on Rotary Mixer	No Filtration	HPLC	MS/MS	In House
2				GC	MS	In House
3	0.1M sulphuric acid	1 hr on rotary mixer, pH adjustment	None	HPLC	MS/MS	NIOSH 9111
4*	0.1M sulfuric acid	30 minutes on rotary mixer	0.45 µm Acrodisc filter	HPLC	MS/MS	In-house developed method
5	NS					
6*	Methanol:pH2 MilliQ(v/v 1:1)	sonications and extraction	0.2µm RC filter	UPLC	MS/MS	modified NIOSH 9111
7*	0.1 M sulfuric acid in UHP water	Samples shaken,1hr tumbled end over end and 20 min sonication	0.2 µm filter	HPLC	MS/MS	based on NIOSH 9111
8	NS					
9*	0.1M Sulfuric Acid	1 hr on rotary mixer, pH adjustment	0.22um Nylon Filter	UPLC	MS/MS	NIOSH 9111
10	0.1 M sulfuric acid	1 Hour Rotary Mixer - Inject	Nil.	HPLC	MS/MS	In-House Method
11*	NS					
12	0.1 M sulfuric acid	1 hr on rotary mixer	No Filtration	HPLC	MS/MS	In house
13	0.1M sulphuric acid	1 hr on rotary mixer, pH adjustment	None	HPLC	MS/MS	NIOSH 9111
14*	Methanol		0.45 µm PVDF	HPLC	DAD	In House
15	0.1 M sulfuric acid	1 hr on rotary mixer	No Filtration	HPLC	MS/MS	based on NIOSH 9111
16*	0.1 M sulfuric acid	1 hr on rotary mixer, pH adjustment	0.45 RC filter	HPLC	MS/MS	in-house based in NIOSH 9111

*Additional information in Table 3.

Table 3 Test Methods Additional Comments

Lab. Code	Participant Comments
4	Eight point calibration curve prepared by spiking known amounts onto swabs. Two QCs prepared with one at the level of remediation and a second at the upper level of the calibration range. Sample S1: Methamphetamine detected below the level of remediation (0.5 µg/swab). Sample S2: Methamphetamine detected above the level of remediation (0.5 µg/swab). Sample S3: Methamphetamine detected above the level of remediation (0.5 µg/swab). Sample S4: MDMA detected above the level of remediation (7 µg/swab).
6	The Recovery correction is based on the internal standard Sample S1, S2, S3, and S4: The recovery is based on IS recovery
7	Corrected on instrument but not for extraction i.e. instrument internal standard correction used NOT extracted internal standard correction.
9	Sample S4: Not Covered by NATA scope of accreditation
11	Blank provided was analysed with samples, no methamphetamine was detected.
14	The internal calibration standards is verified against CRM from Lipomed.
16	Both analytes are corrected by internal standard, but no adjustment made using surrogate recoveries or established bias from spiked samples

3.2 Basis of Participants' Measurement Uncertainty Evaluations

Participants were requested to provide information about their basis of measurement uncertainty (MU) evaluation. Responses received are presented in Tables 4 and **5**. Some responses may be modified so that the participant cannot be identified.

Table 4 Reported Basis of Uncertainty Evaluation

Lab. Code	Approach to Evaluating MU	Information Sources for MU Evaluation*		Guide Document for Evaluating MU
		Precision	Method Bias	
1	Bottom Up (ISO/GUM, fish bone/cause and effect diagram) Coverage factor not reported	Control samples - CRM	Instrument calibration CRM Standard purity	ISO/GUM
2	Top Down - precision and evaluations of the method and laboratory bias k = 2	Control samples - SS Duplicate analysis	Instrument calibration Recoveries of SS	Eurachem/CITAC Guide
3	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Control samples	Instrument calibration Standard purity	ISO/GUM
4†	Top Down - precision and evaluations of the method and laboratory bias k = 2	Control samples - SS Duplicate analysis	Instrument calibration CRM Recoveries of SS	ISO/GUM
5	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Control samples - SS Duplicate analysis	Instrument calibration CRM Recoveries of SS Standard purity	Eurachem/CITAC Guide

Lab. Code	Approach to Evaluating MU	Information Sources for MU Evaluation*		Guide Document for Evaluating MU
		Precision	Method Bias	
6	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Duplicate analysis	CRM	
7	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Control samples - SS	Recoveries of SS	NATA GAG Estimating and Reporting Measurement Uncertainty of Chemical Test Results
8	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Control samples - SS Duplicate analysis	Instrument calibration Laboratory bias from PT studies Standard purity	Eurachem/CITAC Guide
9	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported	Duplicate analysis	Recoveries of SS	ISO/GUM
10	Top Down - precision and evaluations of the method and laboratory bias k = 2	Control samples - SS	Recoveries of SS	NMIA Uncertainty Course
11	Standard deviation of replicate analyses multiplied by 2 or 3 Coverage factor not reported	Control samples - SS	Instrument calibration CRM Recoveries of SS Standard purity	ISO/GUM
12	Bottom Up (ISO/GUM, fish bone/cause and effect diagram) k = 2	Control samples - CRM	Instrument calibration CRM Standard purity	ISO/GUM
13	Top Down - precision and evaluations of the method and laboratory bias k = 2	Control samples	Instrument calibration Standard purity	NMIA Uncertainty Course
14†	Top Down - precision and evaluations of the method and laboratory bias Coverage factor not reported			Nordtest Report TR537
15	Top Down - precision and evaluations of the method and laboratory bias k = 2	Control samples - CRM	Instrument calibration CRM Standard purity	ISO/GUM
16	Standard deviation of replicate analyses multiplied by 2 or 3 k = 2	Control samples - SS	Instrument calibration CRM Recoveries of SS	Eurachem/CITAC Guide

*CRM = Certified Reference Material, RM = Reference Material, SS = Spiked Samples
†Additional information in Table 5.

Table 5 Uncertainty Evaluation Additional Comments

Lab. Code	Participant Comments
4	MU being determined through method validation works that are still ongoing. MU from data currently available used for reporting purposes.
14	The samples are below our normal scope for measurement area. The test is used for examination of suitability of our GCMS and HPLC-DAD methods for detection and quantification of traces. The method uncertainly is not established in this concentration area.

3.3 Details of Participants' Standards

Participants were requested to provide information about their standards used. Responses received are presented in Tables 6 and 7. Some responses may be modified so that that participant cannot be identified.

Table 6 Participants' Standards – Methamphetamine

Lab. Code	Methamphetamine			
	Calibration Standard		Internal Standard	
	Origin	Purity (%)	Origin	Standard
1	Supelco	99.9	Supelco	Methamphetamine-D5
2	NMIA	99.8	Supelco	Methamphetamine-D14
3	Lipomed	99.95	Lipomed	Methamphetamine-D5
4	NMIA	99.8	Supelco	Methamphetamine-D14
5	Lipomed d,l-Methamphetamine.HCI 1mg/mL calibrated in methanol 1mL	99.9	Lipomed d,l-Methamphetamine-D14.HCl	Methamphetamine-D14
6	Chiron	99.9	Supelco	Methamphetamine-D9
7	Lipomed	>98.5	Chiron	Methamphetamine-D5
8	NMIA	99.8	Lipomed	Methamphetamine-D5
9	Supelco	1000 ppm	Supelco	1000ppm
10	Supelco	99.9	Supelco	Methamphetamine-D5
11	Cerilliant M-009, 1mg/mL		Cerilliant M-093, 1mg/mL	Methamphetamine-D14
12	Supelco	99.9	Supelco	Methylamphetamine-D5
13	Lipomed	99.95	Lipomed	Methamphetamine-D5
14	Internal	100		
15	Supelco	99.9	Supelco	Methylamphetamine-D5
16	lipomed	99.8	Cerilliant	Methamphetamine-D9

Table 7 Participants' Standards – MDMA

Lab. Code	MDMA			
	Calibration Standard		Internal Standard	
	Origin	Purity (%)	Origin	Standard
1	Supelco	99.8	Supelco	Methamphetamine-D5
2	NMIA	99.8	Supelco	MDMA-D5

Lab. Code	MDMA			
	Calibration Standard		Internal Standard	
	Origin	Purity (%)	Origin	Standard
3	Lipomed	99.6	Lipomed	MDMA-D5
4	NMIA	99.4	Supelco	MDMA-D5
5	NS			
6	Supelco	99.9	Cerilliant	MDMA-D5
7	Lipomed	>98.5	Chiron	MDMA-D5
8	NS			
9	Supelco	1000 ppm	Supelco	1000ppm
10	Supelco	99.8	Supelco	MDMA-D5
11	NS			
12	Supelco	99.8	Supelco	MDMA-D5
13	Lipomed	99.6	Lipomed	MDMA-D5
14	Internal	100		
15	Supelco	99.8	Supelco	MDMA-D5
16	lipomed	99.7	Lipomed	MDMA-D5

3.4 Participants' Comments

The study coordinator welcomes comments or suggestions from participants as it provides information which can help improve future studies. Responses received are presented in Table 8, along with the study coordinator's response where appropriate. Some responses may be modified so that the participant cannot be identified.

Table 8 Participants' Comments

Lab. Code	Participant Comments	Study Coordinator's Response
10	Thank you.	
11	Ideally use wipes that are commonly used for sampling - these were too small.	Thank you for your suggestion, we will take this into consideration for future studies.
14	The samples are below our normal scope for measurement area. The test is used for examination of suitability of our GCMS and HPLC-DAD methods for detection and quantification of traces. The method uncertainly is not established in this concentration area.	Samples were prepared to have analyte levels near those specified in the Clandestine Drug Laboratory Remediation Guidelines 2011.[2]

4 PRESENTATION OF RESULTS AND STATISTICAL ANALYSIS

4.1 Results Summary

Participant results are listed in Tables 9 to 12 with resultant summary statistics: robust average, median, mean, number of numeric results (N), maximum (Max), minimum (Min), robust standard deviation (Robust SD), robust coefficient of variation (Robust CV), and other estimates of analyte level. Bar charts of results and performance scores are presented in Figures 2 to 5.

An example chart with interpretation guide is shown in Figure 1.

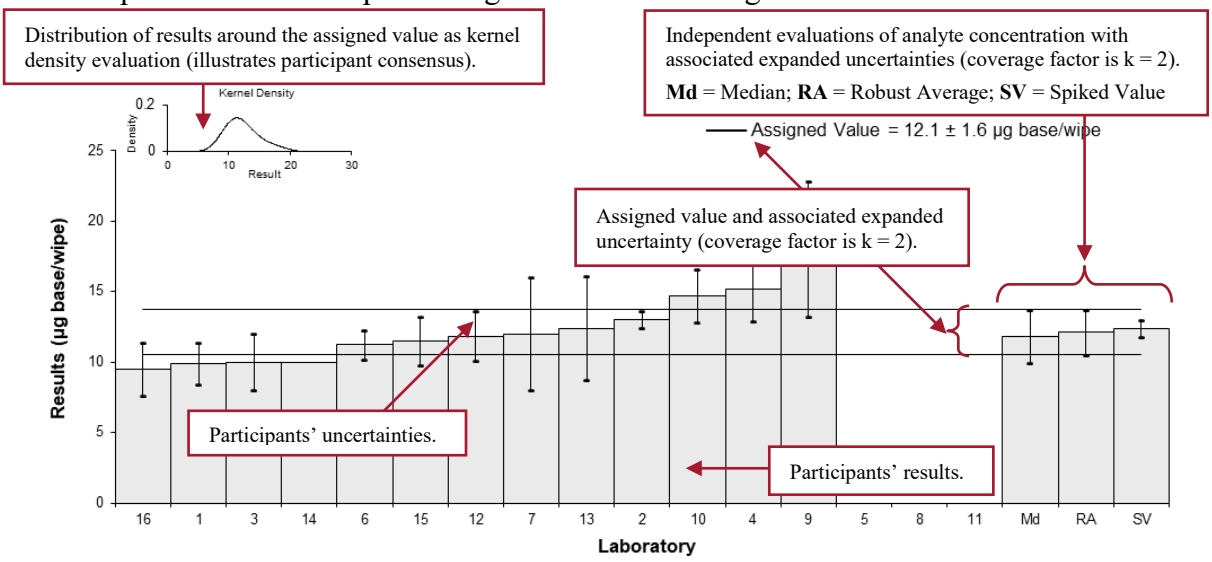


Figure 1 Guide to Presentation of Results

4.2 Outliers and Extreme Outliers

Outliers were defined as results less than 50% or greater than 150% of the robust average and were excluded prior to the calculation of assigned values.[4,5] Extreme outliers (gross errors), such as those due to incorrect units, decimal placement errors, or results from a different proficiency test item, were also removed before calculating summary statistics.[4]

4.3 Assigned Value

Assigned value is defined as the 'value attributed to a particular property of a proficiency or characteristic of a proficiency test item'.[1] In this study, the property is the amount of methamphetamine or MDMA base per wipe in each sample. Assigned values were the robust averages of participants' results (after the removal of any outliers) and the expanded uncertainties were evaluated from the associated robust SDs (Appendix 2).

4.4 Robust Average and Robust Between Laboratories Coefficient of Variation

The robust averages and expanded MUs, and robust CVs (a measure of the variability of participants' results) were calculated using the procedure described in ISO 13528.[6]

4.5 Performance Coefficient of Variation

The performance coefficient of variation (PCV) is a measure of the between laboratories variation that in the judgement of the study coordinator would be expected from participants, given the levels of analytes present. It is important to note that the PCV is a value set by the study coordinator; it is not calculated from the participants' results. It is based on the levels of the analytes in the study and experience from previous studies. By setting a fixed and realistic value for the PCV, a participant's performance does not depend on other participants' performance and can be compared from study to study.

4.6 Standard Deviation for Proficiency Assessment

The standard deviation for proficiency assessment (SDPA, σ) is the product of the assigned value (X) and the PCV, as presented in Equation 1. This value is used for calculation of z-scores.

$$\sigma = X \times PCV \qquad \textit{Equation 1}$$

4.7 *z*-Score

For each participant's result, a z-score is calculated according to Equation 2.

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

where:

z is z-score

χ is a participant's result

X is the assigned value

σ is the SDPA from Equation 1

For the absolute value of a z-score:

- $|z| \leq 2.0$ is acceptable;
- $2.0 < |z| < 3.0$ is questionable; and
- $|z| \geq 3.0$ is unacceptable.

4.8 E_n-Score

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.

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

where:

E_n is E_n-score

χ is a participant's result

X is the assigned value

U_χ is the expanded uncertainty of the participant's result

U_X is the expanded uncertainty of the assigned value

For the absolute value of an E_n-score:

- $|E_n| < 1.0$ is acceptable; and
- $|E_n| \geq 1.0$ is unacceptable.

4.9 Traceability and Measurement Uncertainty

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

5 TABLES AND FIGURES

Table 9

Sample Details

Sample No.	S1
Matrix	Wipe
Analyte	Methamphetamine
Unit	µg base/wipe

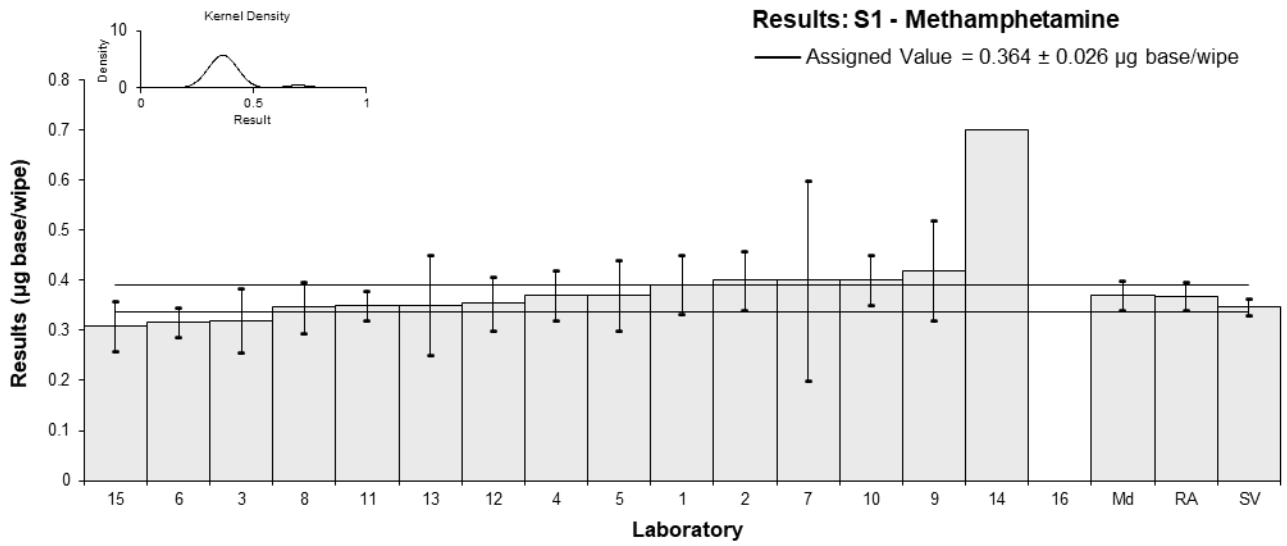
Participant Results

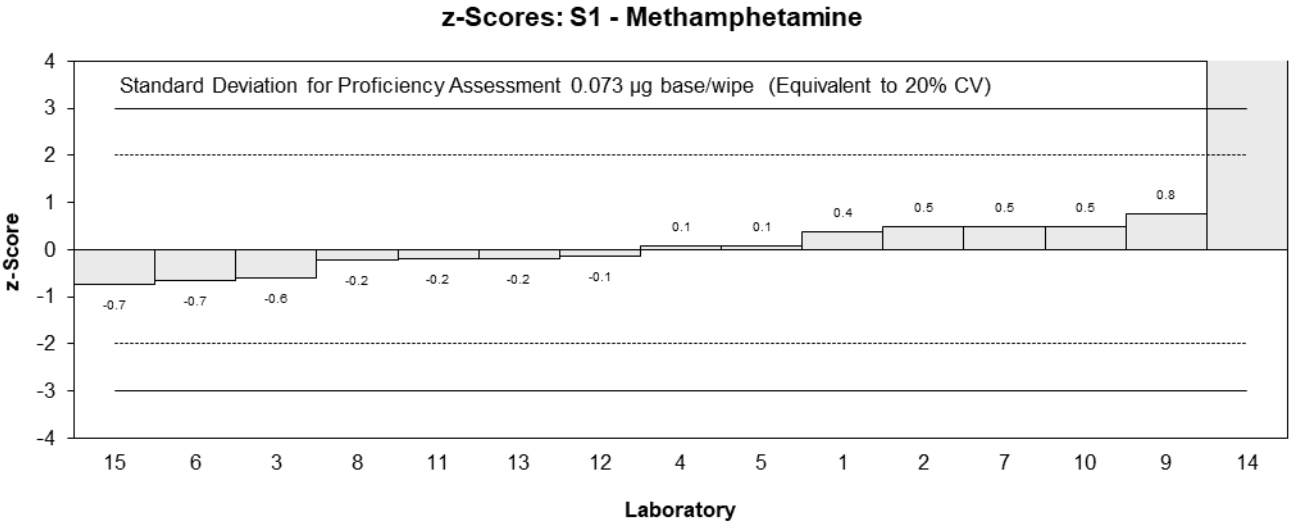
Lab. Code	Result	Uncertainty	Rec	z	E_n
1	0.391	0.059	NR	0.37	0.42
2	0.40	0.06	108.5	0.49	0.55
3	0.32	0.064	128	-0.60	-0.64
4	0.37	0.05	NR	0.08	0.11
5	0.37	0.07	106	0.08	0.08
6	0.317	0.03	97	-0.65	-1.18
7	0.4	0.2	108	0.49	0.18
8	0.347	0.051	NR	-0.23	-0.30
9	0.42	0.10	NR	0.77	0.54
10	0.40	0.05	>97	0.49	0.64
11	0.35	0.03	96.7	-0.19	-0.35
12	0.354	0.053	NR	-0.14	-0.17
13	0.35	0.1	120	-0.19	-0.14
14*	0.7	NR	NR	4.62	12.92
15	0.31	0.05	NR	-0.74	-0.96
16	NS	NS	NS		

*Outlier, see Section 4.2

Statistics

Assigned Value	0.364	0.026
Spike Value	0.347	0.017
Robust Average	0.369	0.028
Median	0.370	0.029
Mean	0.387	
N	15	
Max	0.7	
Min	0.31	
Robust SD	0.043	
Robust CV	12%	


Kernel Density
Density
Result
Results: S1 - Methamphetamine
Assigned Value = 0.364 ± 0.026 µg base/wipe
Results (µg base/wipe)
Laboratory
15 6 3 8 11 13 12 4 5 1 2 7 10 9 14 16 Md RA SV


z-Scores: S1 - Methamphetamine
Standard Deviation for Proficiency Assessment 0.073 µg base/wipe (Equivalent to 20% CV)
z-Score
Laboratory
15 6 3 8 11 13 12 4 5 1 2 7 10 9 14
-0.7 -0.7 -0.6 -0.2 -0.2 -0.2 -0.1 0.1 0.1 0.4 0.5 0.5 0.5 0.8

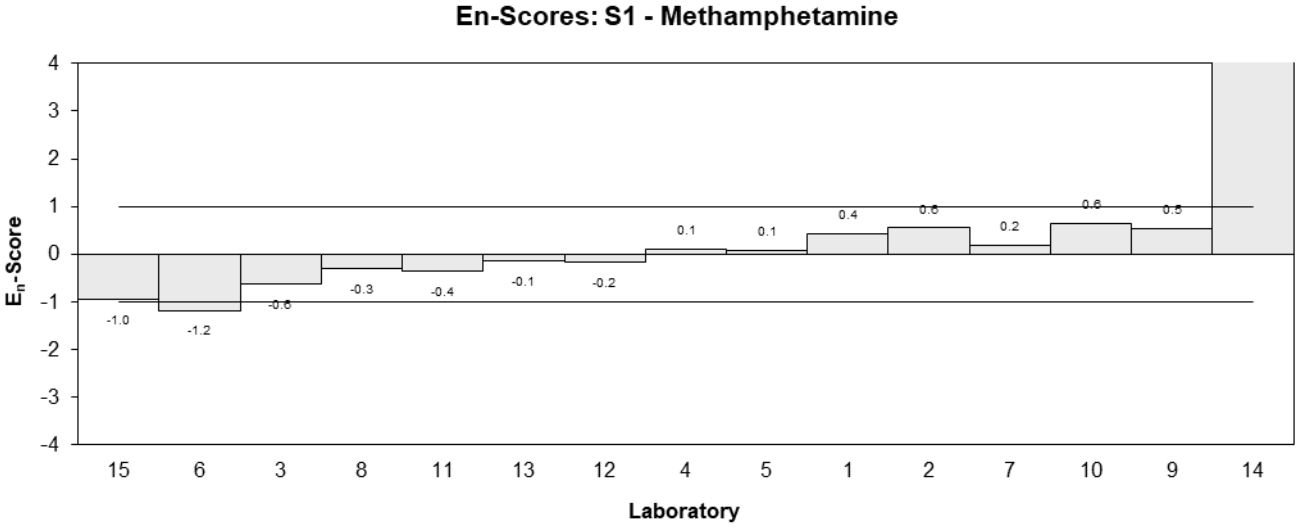

En-Scores: S1 - Methamphetamine
En-Score
Laboratory
15 6 3 8 11 13 12 4 5 1 2 7 10 9 14
-1.0 -1.2 -0.6 -0.3 -0.4 -0.1 -0.2 0.1 0.1 0.4 0.6 0.2 0.6 0.5

Figure 2

Table 10

Sample Details

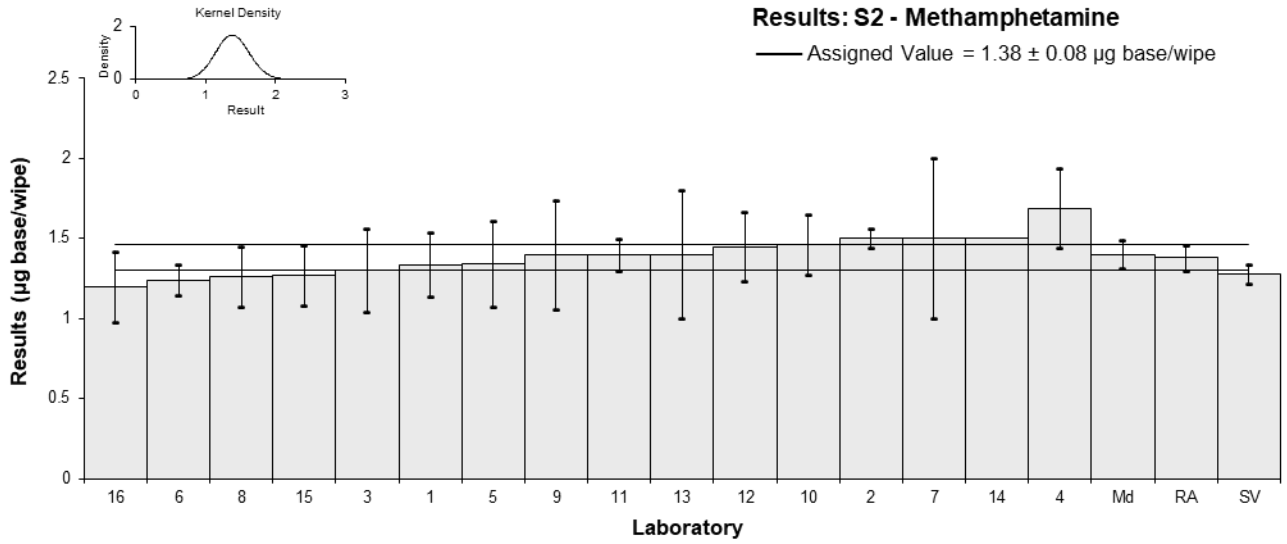
Sample No.	S2
Matrix	Wipe
Analyte	Methamphetamine
Unit	µg base/wipe

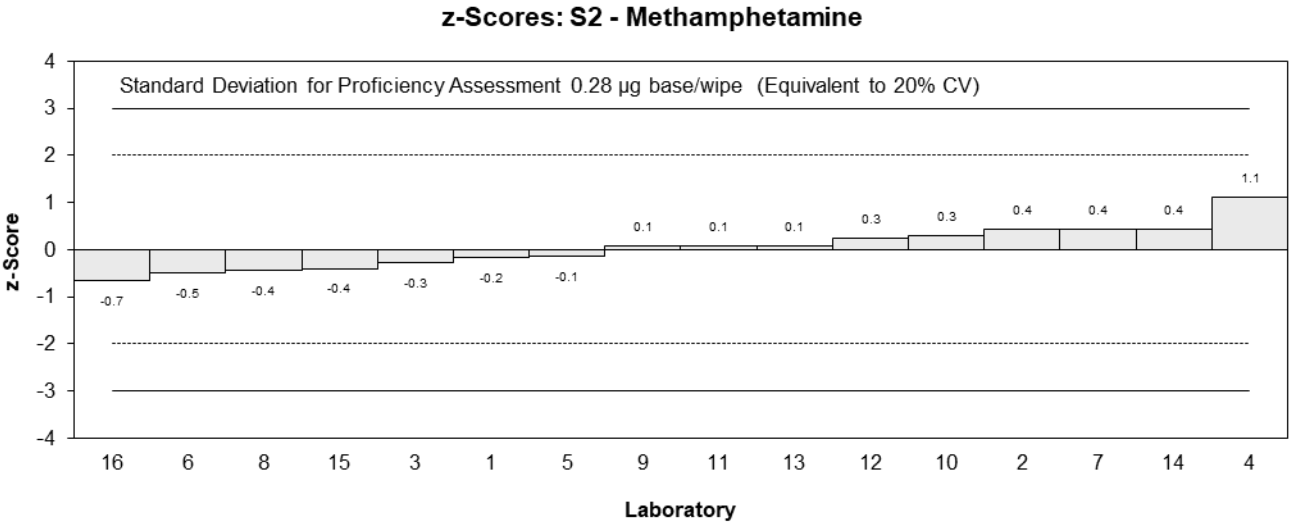
Participant Results

Lab. Code	Result	Uncertainty	Rec	z	E_n
1	1.337	0.201	NR	-0.16	-0.20
2	1.5	0.06	108.5	0.43	1.20
3	1.3	0.26	124	-0.29	-0.29
4	1.69	0.25	NR	1.12	1.18
5	1.34	0.27	106	-0.14	-0.14
6	1.241	0.096	95	-0.50	-1.11
7	1.5	0.5	108	0.43	0.24
8	1.26	0.19	NR	-0.43	-0.58
9	1.4	0.34	NR	0.07	0.06
10	1.46	0.19	>97	0.29	0.39
11	1.4	0.1	96.7	0.07	0.16
12	1.449	0.217	NR	0.25	0.30
13	1.4	0.4	117	0.07	0.05
14	1.5	NR	NR	0.43	1.50
15	1.27	0.19	NR	-0.40	-0.53
16	1.2	0.22	130	-0.65	-0.77

Statistics

Assigned Value	1.38	0.08
Spike Value	1.28	0.06
Robust Average	1.38	0.08
Median	1.40	0.09
Mean	1.39	
N	16	
Max	1.69	
Min	1.2	
Robust SD	0.12	
Robust CV	9%	


Kernel Density
Density
Result
Results: S2 - Methamphetamine
Assigned Value = 1.38 ± 0.08 µg base/wipe
Results (µg base/wipe)
Laboratory
16 6 8 15 3 1 5 9 11 13 12 10 2 7 14 4 Md RA SV


z-Scores: S2 - Methamphetamine
Standard Deviation for Proficiency Assessment 0.28 µg base/wipe (Equivalent to 20% CV)
z-Score
-0.7 -0.5 -0.4 -0.4 -0.3 -0.2 -0.1 0.1 0.1 0.1 0.3 0.3 0.4 0.4 0.4 1.1
Laboratory
16 6 8 15 3 1 5 9 11 13 12 10 2 7 14 4

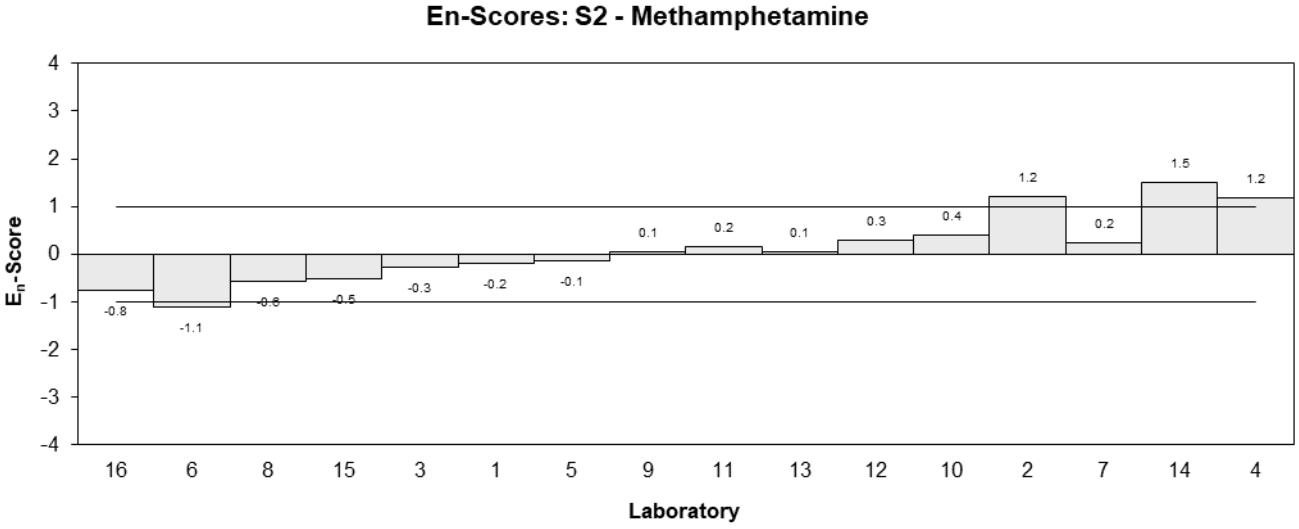

En-Scores: S2 - Methamphetamine
En-Score
-0.8 -1.1 -0.6 -0.5 -0.3 -0.2 -0.1 0.1 0.2 0.1 0.3 0.4 1.2 0.2 1.5 1.2
Laboratory
16 6 8 15 3 1 5 9 11 13 12 10 2 7 14 4

Figure 3

Table 11

Sample Details

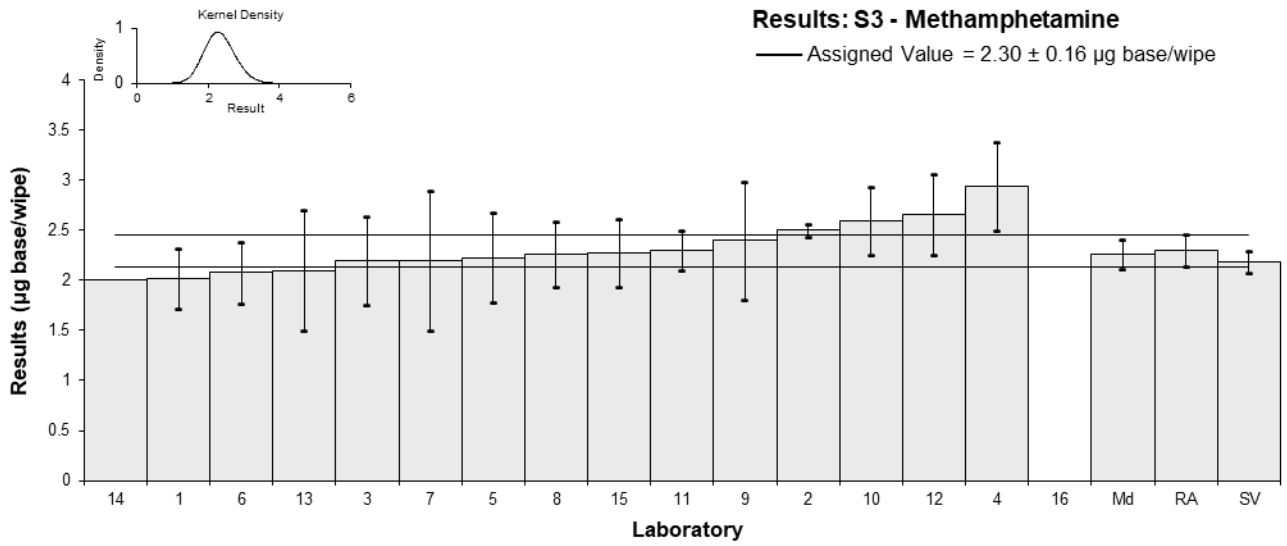
Sample No.	S3
Matrix	Wipe
Analyte	Methamphetamine
Unit	µg base/wipe

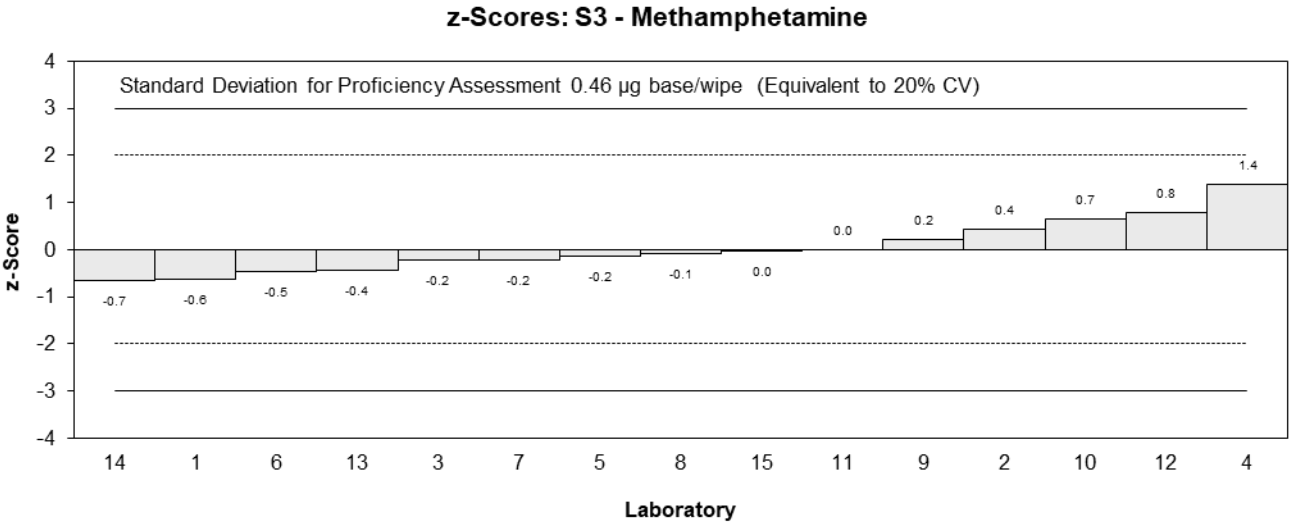
Participant Results

Lab. Code	Result	Uncertainty	Rec	z	E_n
1	2.016	0.302	NR	-0.62	-0.83
2	2.5	0.06	108.5	0.43	1.17
3	2.2	0.44	125	-0.22	-0.21
4	2.94	0.44	NR	1.39	1.37
5	2.23	0.45	106	-0.15	-0.15
6	2.081	0.306	99	-0.48	-0.63
7	2.2	0.7	108	-0.22	-0.14
8	2.26	0.33	NR	-0.09	-0.11
9	2.4	0.59	NR	0.22	0.16
10	2.60	0.34	>97	0.65	0.80
11	2.3	0.2	96.7	0.00	0.00
12	2.659	0.399	NR	0.78	0.84
13	2.1	0.6	110	-0.43	-0.32
14	2	NR	NR	-0.65	-1.87
15	2.28	0.34	NR	-0.04	-0.05
16	NS	NS	NS		

Statistics

Assigned Value	2.30	0.16
Spike Value	2.19	0.11
Robust Average	2.30	0.16
Median	2.26	0.15
Mean	2.32	
N	15	
Max	2.94	
Min	2	
Robust SD	0.25	
Robust CV	11%	


Kernel Density
Density
Result
Results: S3 - Methamphetamine
Assigned Value = 2.30 ± 0.16 µg base/wipe
Results (µg base/wipe)
Laboratory
14 1 6 13 3 7 5 8 15 11 9 2 10 12 4 16 Md RA SV


z-Scores: S3 - Methamphetamine
Standard Deviation for Proficiency Assessment 0.46 µg base/wipe (Equivalent to 20% CV)
z-Score
Laboratory
14 1 6 13 3 7 5 8 15 11 9 2 10 12 4
-0.7 -0.6 -0.5 -0.4 -0.2 -0.2 -0.2 -0.1 0.0 0.0 0.2 0.4 0.7 0.8 1.4

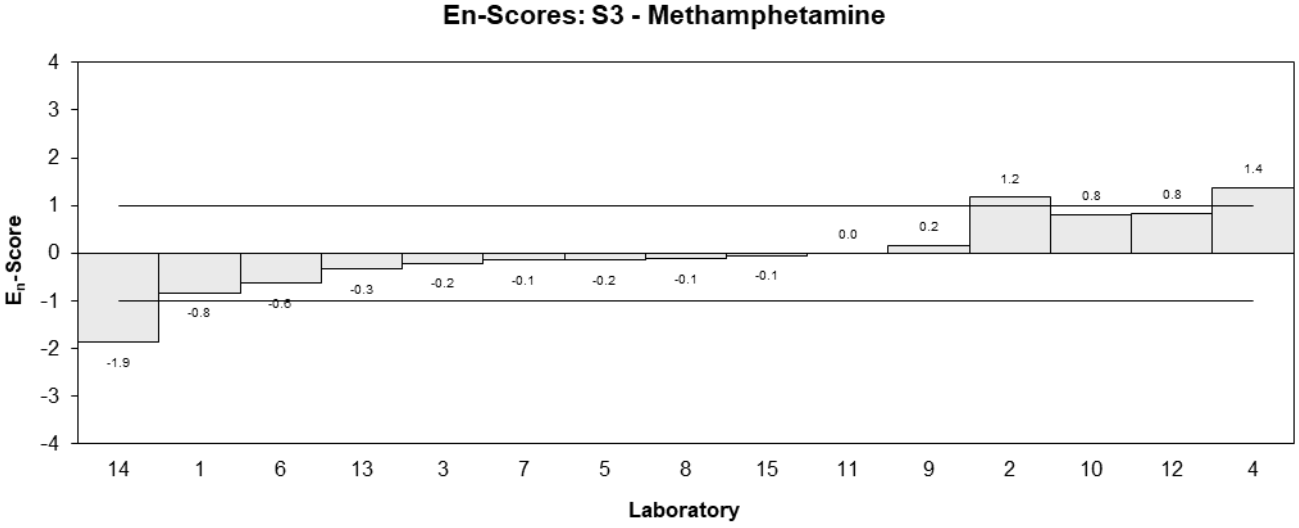

En-Scores: S3 - Methamphetamine
En-Score
Laboratory
14 1 6 13 3 7 5 8 15 11 9 2 10 12 4
-1.9 -0.8 -0.6 -0.3 -0.2 -0.1 -0.2 -0.1 -0.1 0.0 0.2 1.2 0.8 0.8 1.4

Figure 4

Table 12

Sample Details

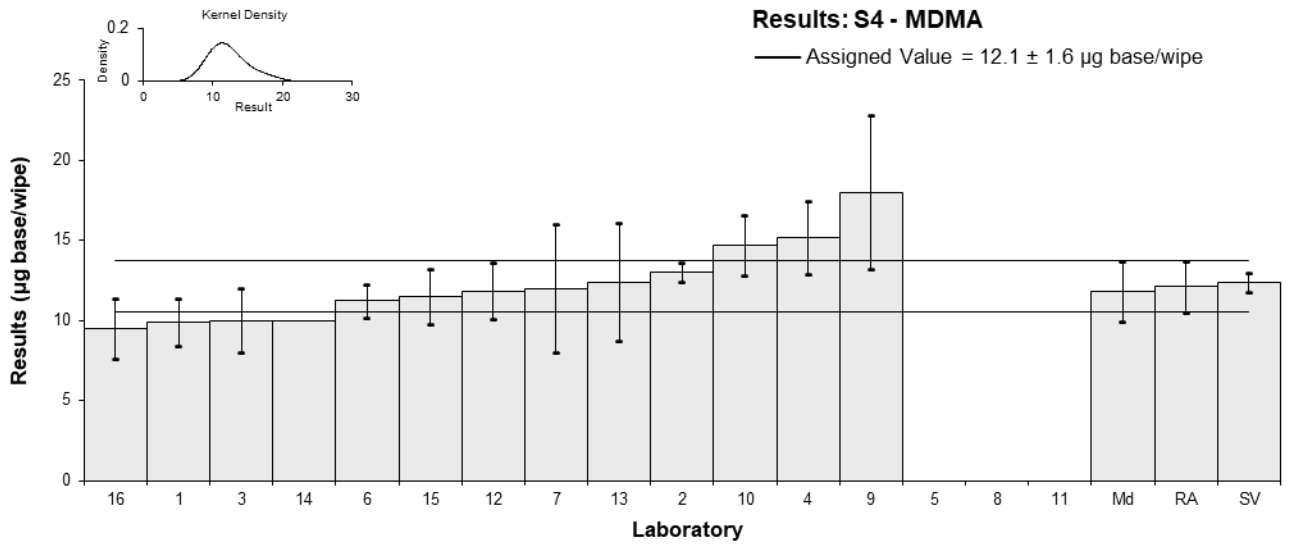
Sample No.	S4
Matrix	Wipe
Analyte	MDMA
Unit	µg base/wipe

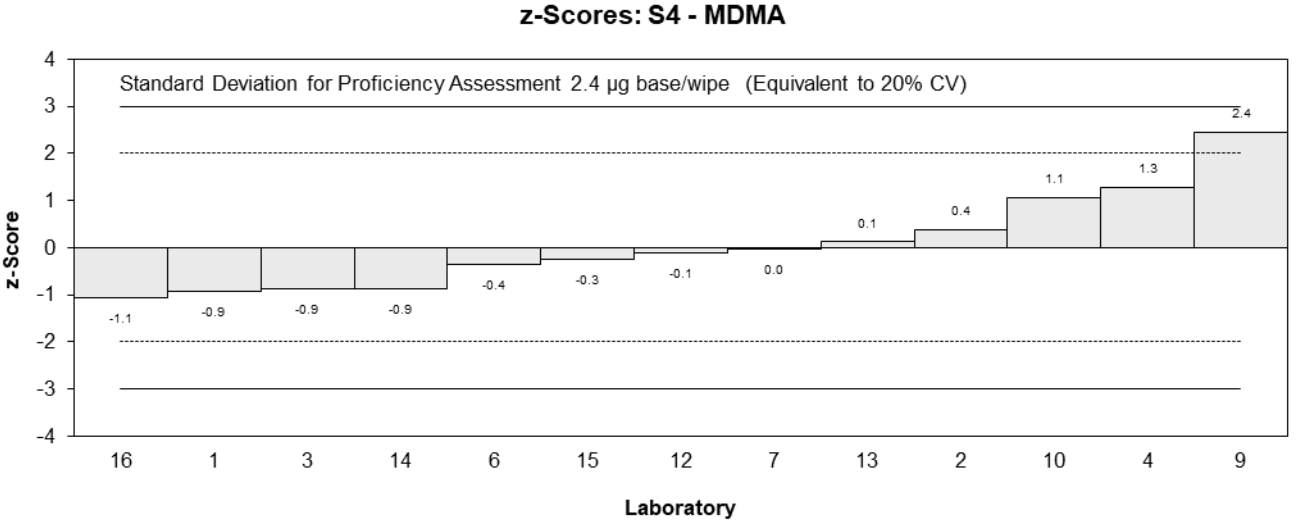
Participant Results

Lab. Code	Result	Uncertainty	Rec	z	E_n
1	9.86	1.48	NR	-0.93	-1.03
2	13	0.6	108.6	0.37	0.53
3	10	2	133	-0.87	-0.82
4	15.19	2.27	NR	1.28	1.11
5	NS	NS	NS		
6	11.22	1.04	73	-0.36	-0.46
7	12	4	101	-0.04	-0.02
8	NS	NS	NS		
9	18	4.8	NR	2.44	1.17
10	14.7	1.9	>97	1.07	1.05
11	NS	NS	NS		
12	11.84	1.78	NR	-0.11	-0.11
13	12.4	3.7	135	0.12	0.07
14	10	NR	NR	-0.87	-1.31
15	11.5	1.7	NR	-0.25	-0.26
16	9.5	1.9	120	-1.07	-1.05

Statistics

Assigned Value	12.1	1.6
Spike Value	12.4	0.6
Robust Average	12.1	1.6
Median	11.8	1.9
Mean	12.2	
N	13	
Max	18	
Min	9.5	
Robust SD	2.3	
Robust CV	19%	


Kernel Density
Density
Result
Results: S4 - MDMA
Assigned Value = 12.1 ± 1.6 µg base/wipe
Results (µg base/wipe)
Laboratory
16 1 3 14 6 15 12 7 13 2 10 4 9 5 8 11 Md RA SV


z-Scores: S4 - MDMA
Standard Deviation for Proficiency Assessment 2.4 µg base/wipe (Equivalent to 20% CV)
z-Score
-1.1 -0.9 -0.9 -0.9 -0.4 -0.3 -0.1 0.0 0.1 0.4 1.1 1.3 2.4
Laboratory
16 1 3 14 6 15 12 7 13 2 10 4 9

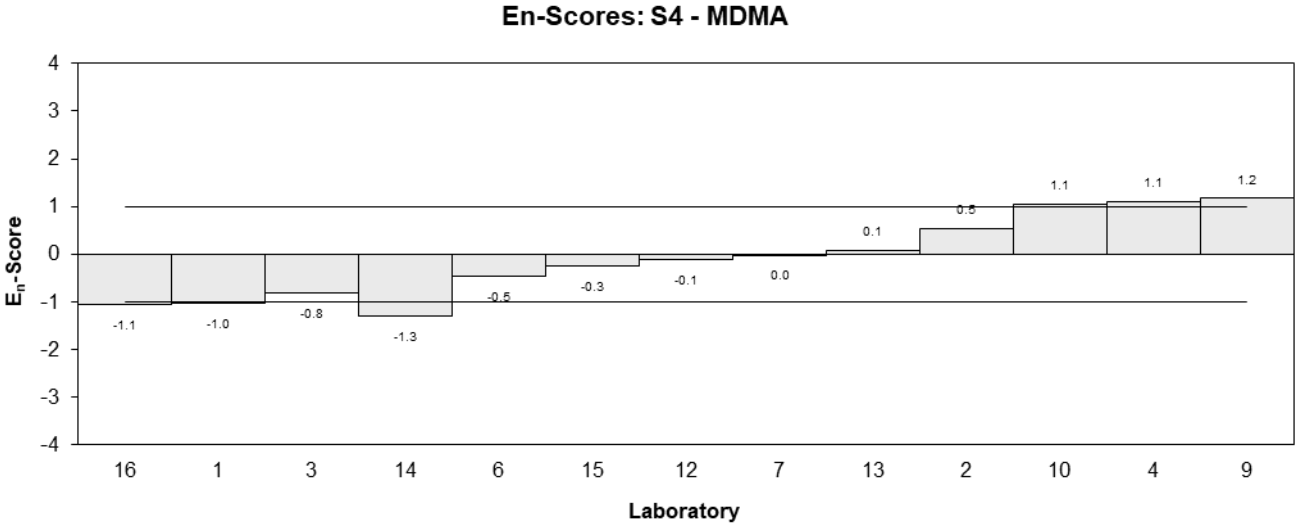

En-Scores: S4 - MDMA
En-Score
-1.1 -1.0 -0.8 -1.3 -0.5 -0.3 -0.1 0.0 0.1 0.5 1.1 1.1 1.2
Laboratory
16 1 3 14 6 15 12 7 13 2 10 4 9

Figure 5

6 DISCUSSION OF RESULTS

6.1 Assigned Value

The assigned values were the robust averages of participants' results. If there were results less than 50% and greater than 150% of the robust average, these were excluded from the calculation of each assigned value.[4,5] The robust averages and associated expanded uncertainties were calculated using the procedure described in ISO 13528.[6] The calculation of the expanded uncertainty for a robust average is presented in Appendix 2, using Sample S3 as an example.

A comparison of the assigned and spiked values is presented in Table 13. Assigned values were between 98% and 108% of the spiked values, providing good support for the assigned values and as well as evidence for the stability of these analytes in the test samples.

Table 13 Comparison of Assigned Values and Spiked Values

Sample	Analyte	Assigned Value (µg base/wipe)	Spiked Value (µg base/wipe)	Assigned Value / Spiked Value (%)
S1	Methamphetamine	0.364	0.347	105
S2	Methamphetamine	1.38	1.28	108
S3	Methamphetamine	2.30	2.19	105
S4	MDMA	12.1	12.4	98

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.

6.2 Measurement Uncertainty Reported by Participants

Participants were asked to report an evaluation of the expanded MU associated with their results, and the basis of this 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 client's instruction so requires.[7]

Laboratories **1**, **10**, **12**, and **15** reported their uncertainties as a relative uncertainty (i.e. *x* %) rather than as µg base/wipe as requested for this PT study. These uncertainty values were modified accordingly by the study coordinator for this report.

Of 59 numeric results, 55 (93%) were reported with an associated MU. Participants used a wide variety of procedures to evaluate the uncertainties of their reported results (Tables 4 and 5). One participant reported using NATA GAG Estimating and Reporting Measurement Uncertainty of Chemical Test Results as their guide; this document has been officially removed from the NATA website and is considered obsolete.[9]

Laboratory **14** did not report uncertainties for any of their reported results. This participant was not accredited to ISO/IEC 17025.

The magnitude of reported uncertainties was within the range of 2.4% to 50% relative.

Participants were asked to report the coverage factor of their associated measurement uncertainty (Table 4). Seven participants reported their coverage factor, and all used a coverage factor of k = 2.

Uncertainties associated with results returning an acceptable *z*-score but an unacceptable E_n-score may have been undervalued.

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 the uncertainty to no more than two significant figures and then to write the result with the corresponding number of decimal places. For example, instead of 2.659 ± 0.399 µg base/wipe, it is recommended to report this as 2.66 ± 0.40 µg base/wipe.[8]

6.3 *z*-Score

Standard deviations for proficiency assessment (SDPA) equivalent to 20% PCV were used to calculate *z*-scores. Between-laboratory CVs and SDPAs (as PCV) for scored analytes in this study are presented for comparison in Table 14.

Table 14 Assigned Values, Between-Laboratory CVs and SDPAs (as PCV)

Sample	Analyte	Assigned Value (µg base/wipe)	Between-Laboratory CV* (%)	SDPA (as PCV) (%)
S1	Methamphetamine	0.364	11	20
S2	Methamphetamine	1.38	9	20
S3	Methamphetamine	2.30	11	20
S4	MDMA	12.1	19	20

*Robust between-laboratory CV with outliers removed, if applicable.

Of 59 results for which *z*-scores were calculated, 57 (97%) returned a *z*-score of $|z| \leq 2.0$, indicating acceptable performance.

All laboratories except Laboratories **9** and **14** returned acceptable *z*-scores for all reported numeric results.

For Laboratory **9**, all methamphetamine results returned acceptable *z*-scores, however their Sample S4 MDMA result was high; this participant may need to review their methodology or standards used for MDMA analysis.

For Laboratory **14**, their Sample S1 methamphetamine result was approximately twice the assigned value, whereas all their other results returned acceptable *z*-scores.

The dispersal of participants' *z*-scores is presented graphically by laboratory in Figure 6.

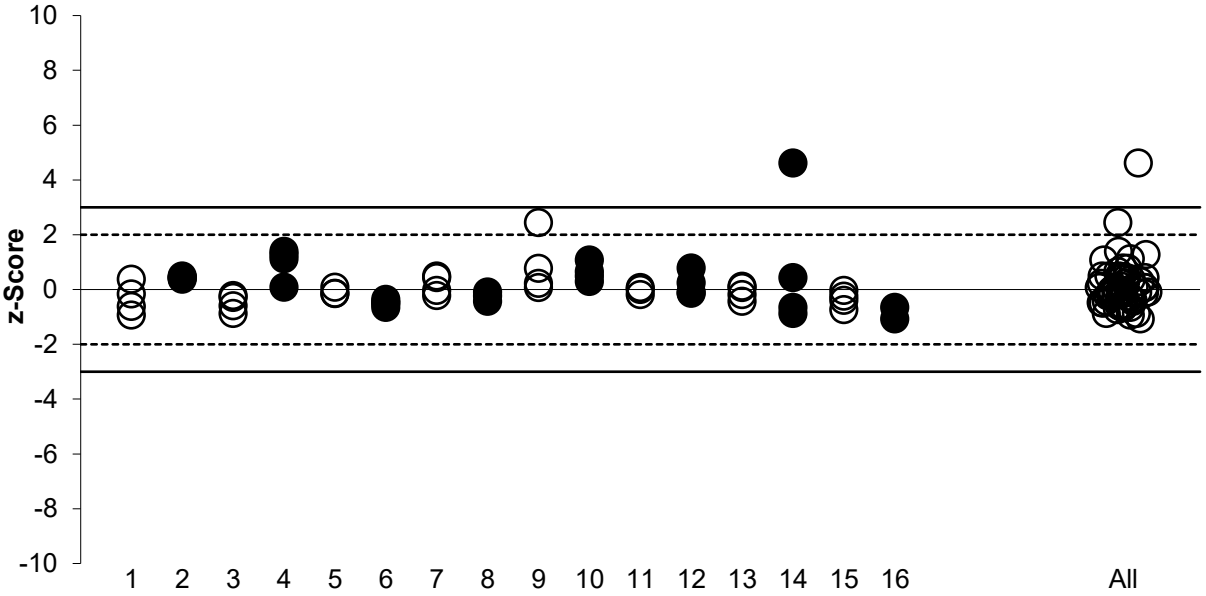


Figure 6 *z*-Score Dispersal by Laboratory

6.4 E_n-Score

E_n-scores can be interpreted in conjunction with z-scores, as an unacceptable E_n-score may either be caused by issues with measurement, or uncertainty evaluation, or both. If a participant did not report an uncertainty with a result, an expanded uncertainty of zero (0) was used to calculate the E_n-score.

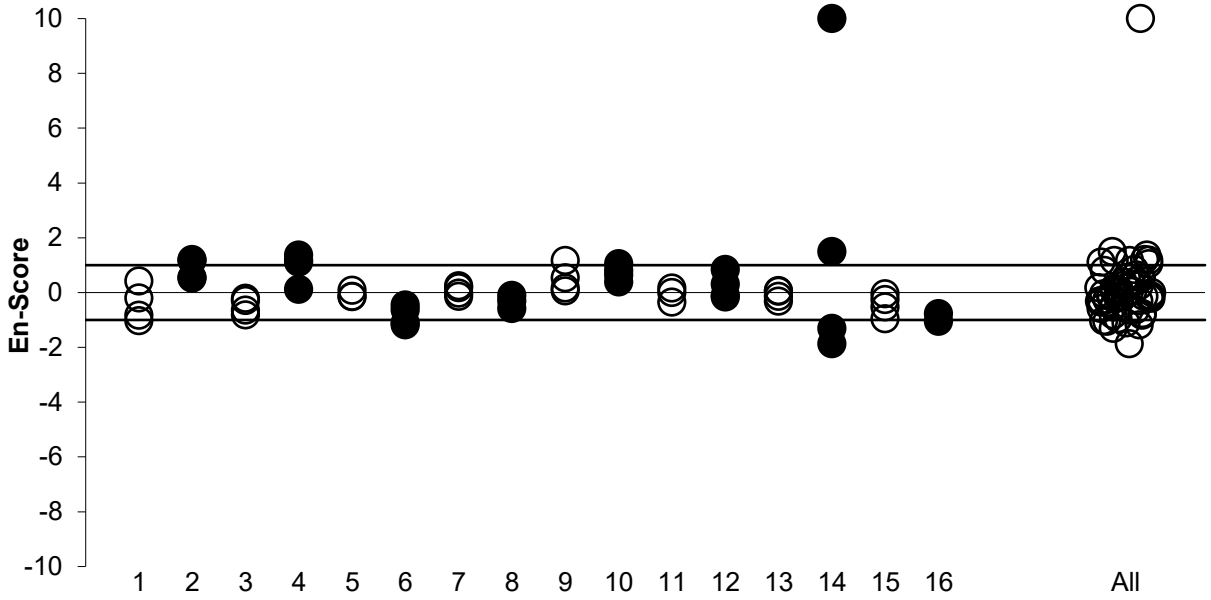
Of 59 results for which E_n-scores were calculated, 44 (75%) returned an E_n-score of $|E_n| < 1.0$, indicating agreement of the participant's result with the assigned value within their respective expanded uncertainties.

Five participants returned acceptable E_n-scores for all four scored results: Laboratories **3**, **7**, **12**, **13** and **15**.

Three participants analysed methamphetamine only and returned acceptable E_n-scores for all scored results: Laboratories **5**, **8** and **11**.

Laboratory **14** returned unacceptable E_n-scores for all four scored results. This participant had not reported any uncertainties. As the participant had returned acceptable z-scores for Samples S2, S3 and S4, if they had reported reasonable and fit-for-purpose uncertainties, then their resulting E_n-scores for these samples may have been acceptable.

The dispersal of participants' E_n-scores is presented graphically by laboratory in Figure 7.



E_n-scores greater than 10.0 have been plotted at 10.0.

Figure 7 E_n-Score Dispersal by Laboratory

6.5 Participants' Analytical Methods

Participants were requested to analyse the samples using their normal test methods and to report a single result for each sample as they would normally report to a client. Results reported in this way reflect the true variability of results reported to laboratory clients.

The measurement of MDMA in Sample S4 posed a greater analytical challenge for participants than the measurement of methamphetamine in Samples S1, S2 and S3. The between-laboratory CV for Sample S4 was 19%, nearly double that observed for methamphetamine, which ranged from 9% to 11%.

A summary of participants' accreditation status, methods and reference standards is presented in Table 15.

Table 15 Summary of Participants' Analyses

		Lab. Code
Accreditation	Yes to ISO/IEC 17025	1, 3, 4, 5, 7, 8, 9, 11, 12, 13, 15
	Not Accredited	2, 6, 10, 14, 16
Sample Treatment	Rotary Mixer / Shaking / Tumbling	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16
	Sonication	6, 7
	pH Adjustment	2, 3, 9, 13, 16
	Derivatisation	2
Filter Used	Yes	4, 6, 7, 9, 11, 14, 16
	No	1, 3, 5, 8, 10, 12, 13, 15
Desorption Solution	0.1 M Sulfuric Acid	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 15, 16
	Methanol(/Acid/Water)	6, 14
Instrument Used for Quantification	GC-MS	2
	HPLC-DAD	14
	HPLC-MS	11
	HPLC-MS/MS	1, 3, 4, 7, 8, 10, 12, 13, 15, 16
	UPLC-MS/MS	5, 6, 9
Sources of Calibration Standard	NMIA	2, 4, 8
	Cerilliant	11
	Chiron	6 (Methamphetamine)
	Lipomed	3, 5, 7, 13, 16
	Supelco	1, 6 (MDMA), 9, 10, 12, 15
	Other	14
Internal Standard – Methamphetamine	Methamphetamine-D5	1, 3, 7, 8, 10, 12, 13, 15
	Methamphetamine-D9	6, 16
	Methamphetamine-D14	2, 4, 5, 11
	Other/Not Reported	9, 14
Internal Standard – MDMA	MDMA-D5	2, 3, 4, 6, 7, 10, 12, 13, 15, 16
	Methamphetamine-D5	1
	Other/Not Reported	9

Most participants used methods that were based on NIOSH 9111.[10] Some participants reported using in-house methods, and in many cases these methodologies were also similar to NIOSH 9111 (e.g. using 0.1 M sulfuric acid desorption solution, mixing for at least 1 h, and analysing using liquid chromatography techniques coupled to mass spectrometry).

Two participants reported using methanol in their desorption solution. One participant reported using gas chromatography coupled to mass spectrometry (GC-MS) for analysis and another participant reported using high performance liquid chromatography coupled to diode array detection (HPLC-DAD).

Comparisons of *z*-scores with various methodology parameters for scored analytes are given in Figures 8 to 12. There was no trend observed with the different methodologies employed.

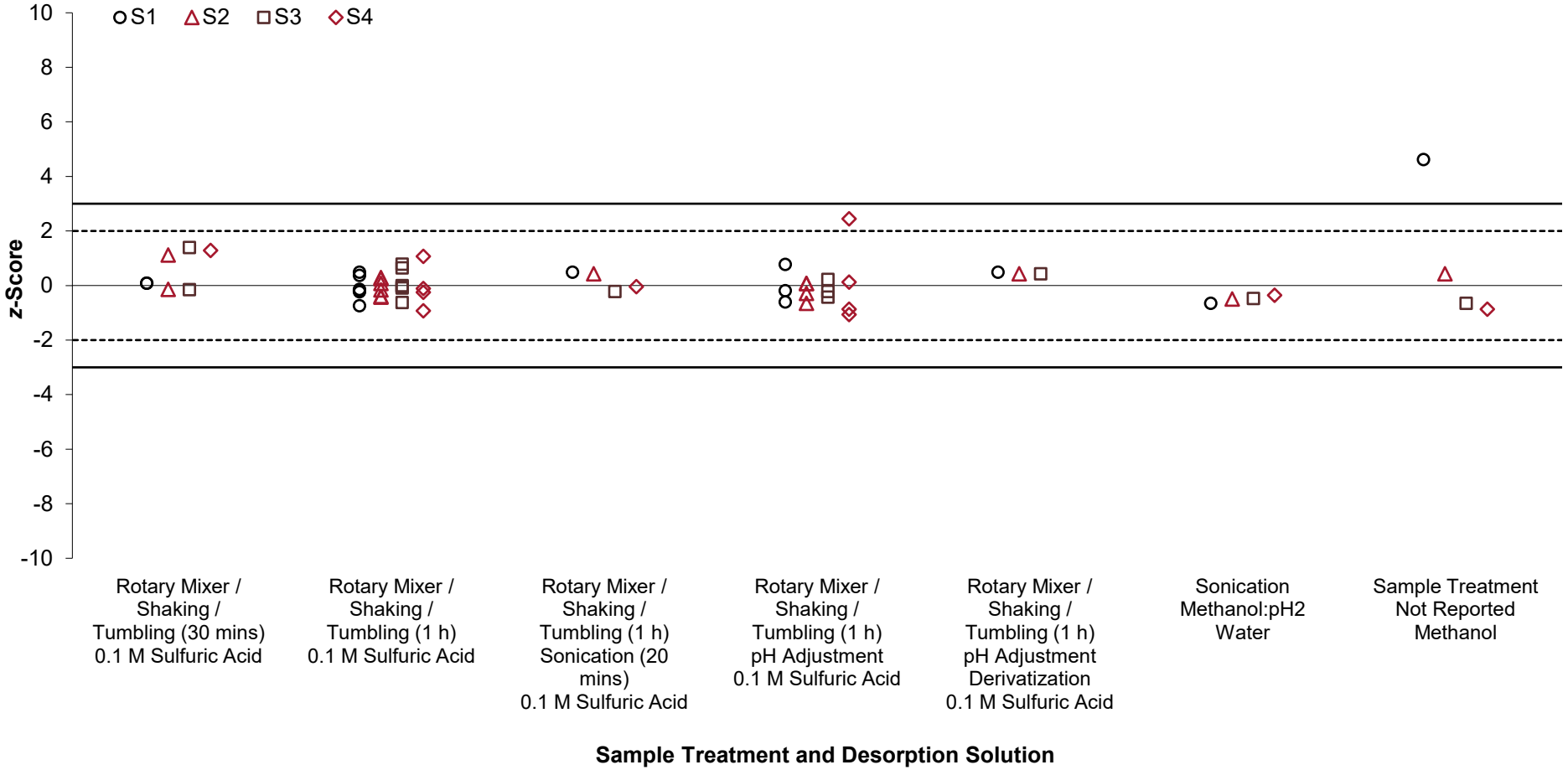


Figure 8 *z*-Scores vs Sample Treatment and Desorption Solution

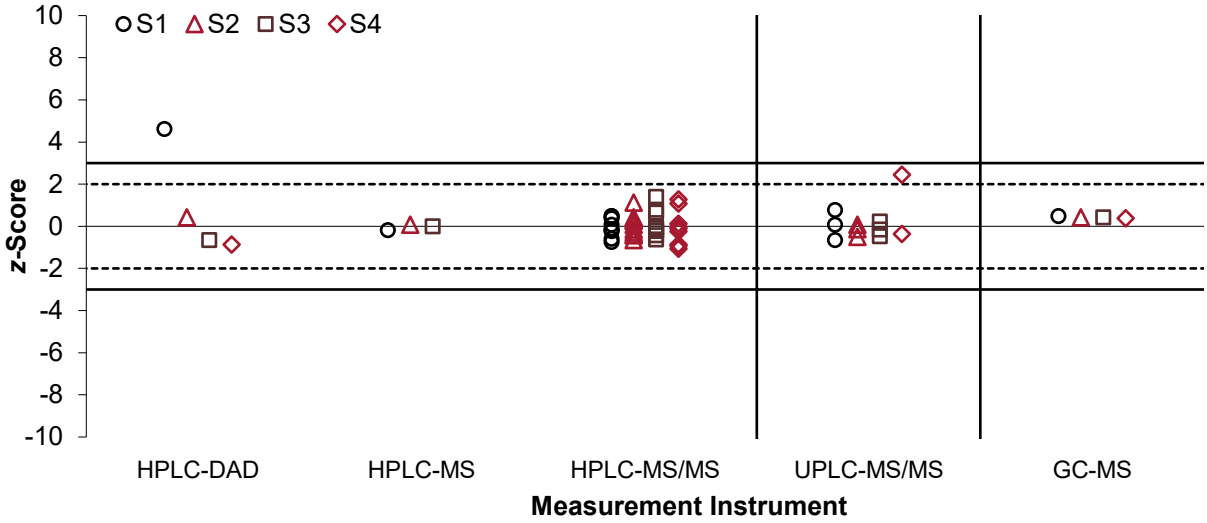


Figure 9 *z*-Scores vs Measurement Instrument

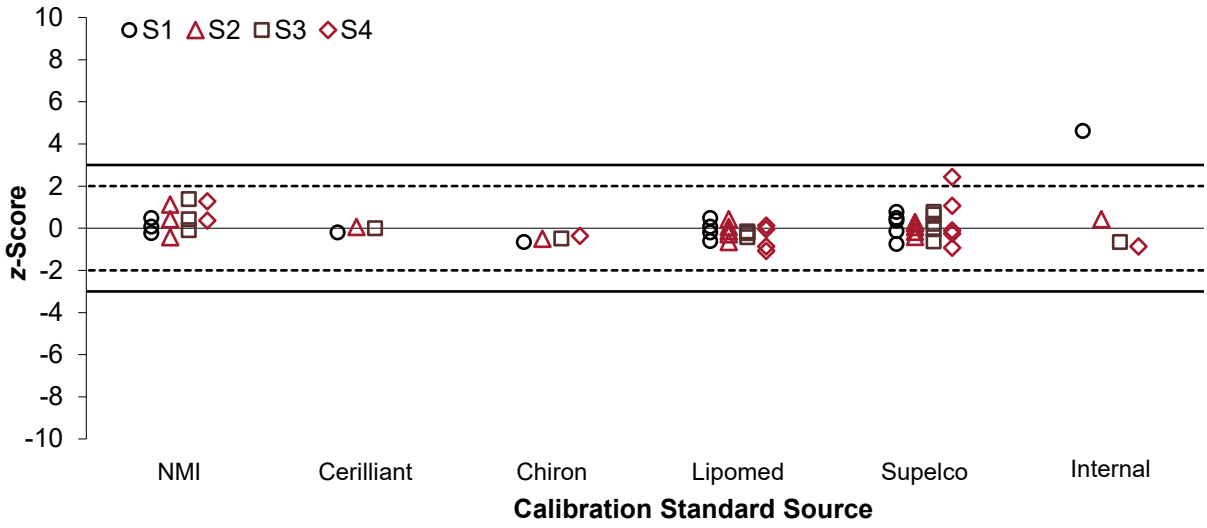


Figure 10 *z*-Scores vs Calibration Standard Source

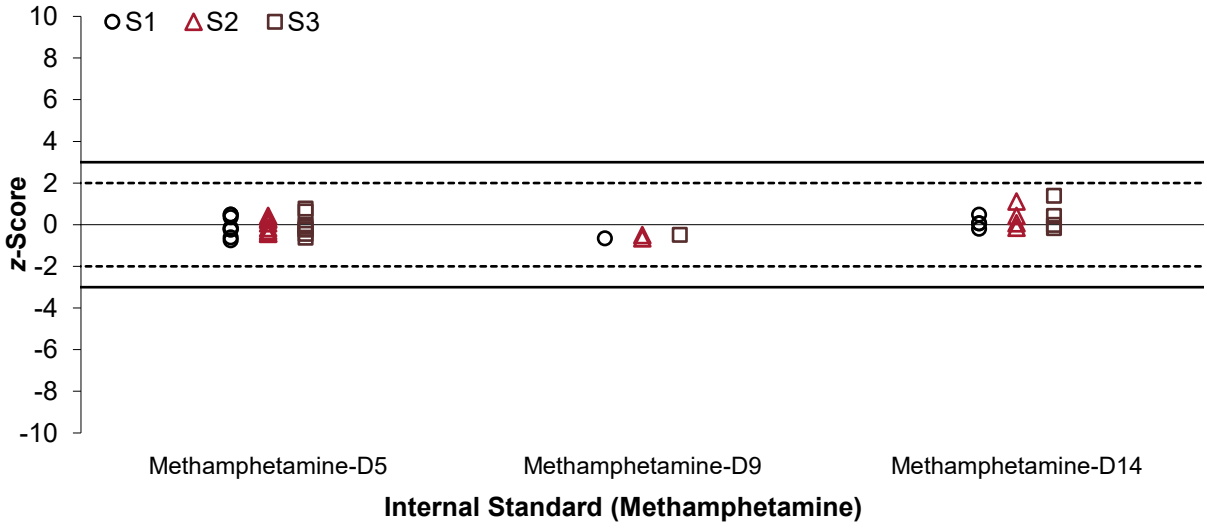


Figure 11 *z*-Scores vs Internal Standard (Methamphetamine)

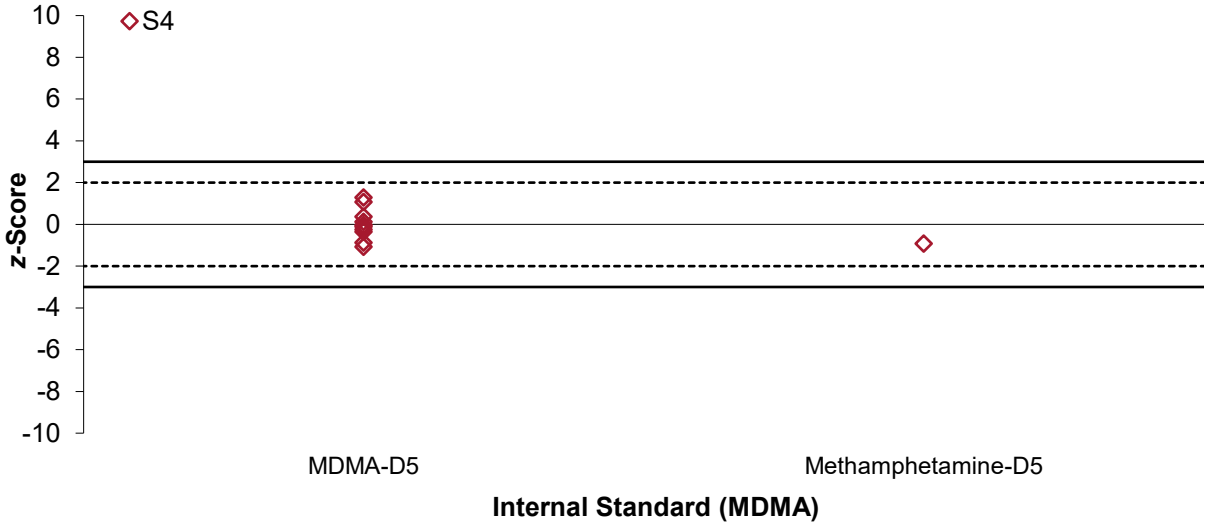


Figure 12 *z*-Scores vs Internal Standard (MDMA)

6.6 Clandestine Laboratory Remediation Investigation Levels

The Australian Government Clandestine Drug Laboratory Remediation Guidelines specifies the investigation levels (ILs) for various chemicals at clandestine laboratory sites.[2]

For methamphetamine in indoor residential surface areas, the IL criteria is 0.5 µg/100 cm^2 (corresponding in this study to 0.5 µg/wipe). For MDMA in indoor residential surface areas, the IL criteria is 7 µg/100 cm^2 (corresponding in this study to 7 µg/wipe). Laboratories should be able to identify if a sample is above or below the relevant IL.

In this study, Sample S1 was prepared with a methamphetamine concentration below the relevant IL, representing a theoretical location that would not require remediation. In contrast, Samples S2 and S3 contained methamphetamine above than the IL, and Sample S4 contained MDMA above the IL, indicating theoretical locations where remediation would be necessary.

A summary of spiked values (SV), assigned values (AV), results and uncertainties for each sample is presented graphically in Figures 13 to 16.

In this study, the results reported were correctly above or below the relevant IL, as compared to the SV and AV for that sample, with a few inconsistencies. Laboratories **7** and **9** correctly reported methamphetamine in Sample S1 below the IL, however their uncertainties spanned the IL. Additionally in Sample S1, Laboratory **14** reported methamphetamine higher than the IL, which would have resulted in the incorrect remediation conclusion being drawn.

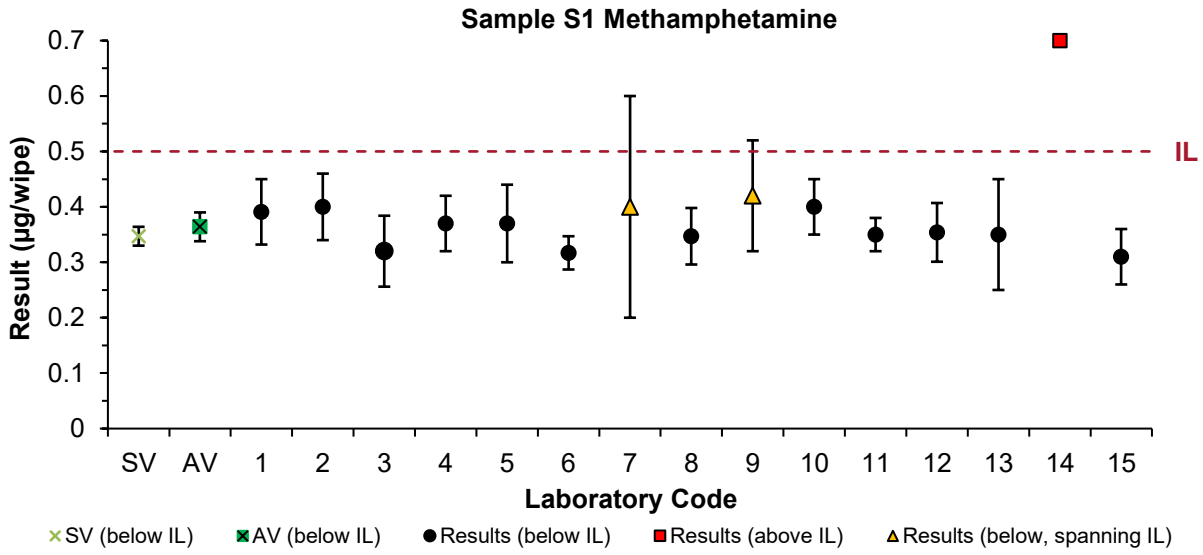


Figure 13 Sample S1 Spiked Value, Assigned Value and Participant Results

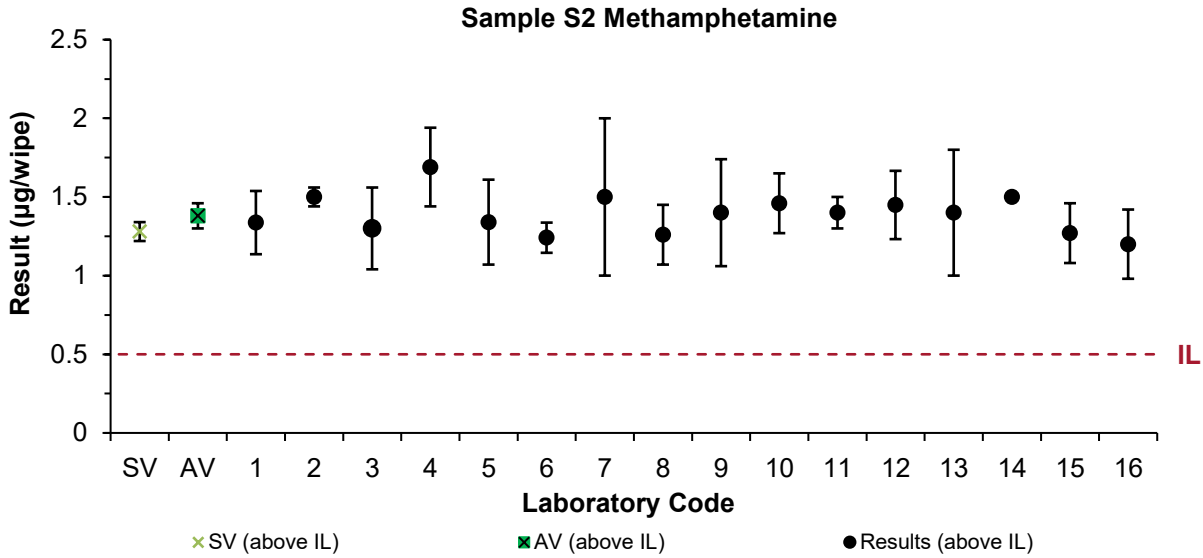


Figure 14 Sample S2 Spiked Value, Assigned Value and Participant Results

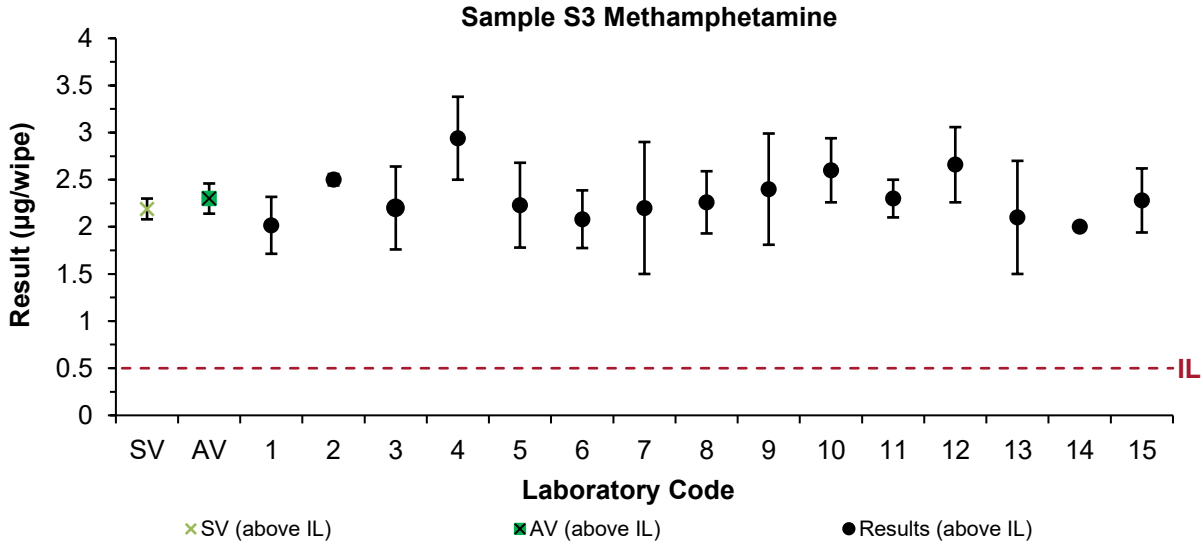


Figure 15 Sample S3 Spiked Value, Assigned Value and Participant Results

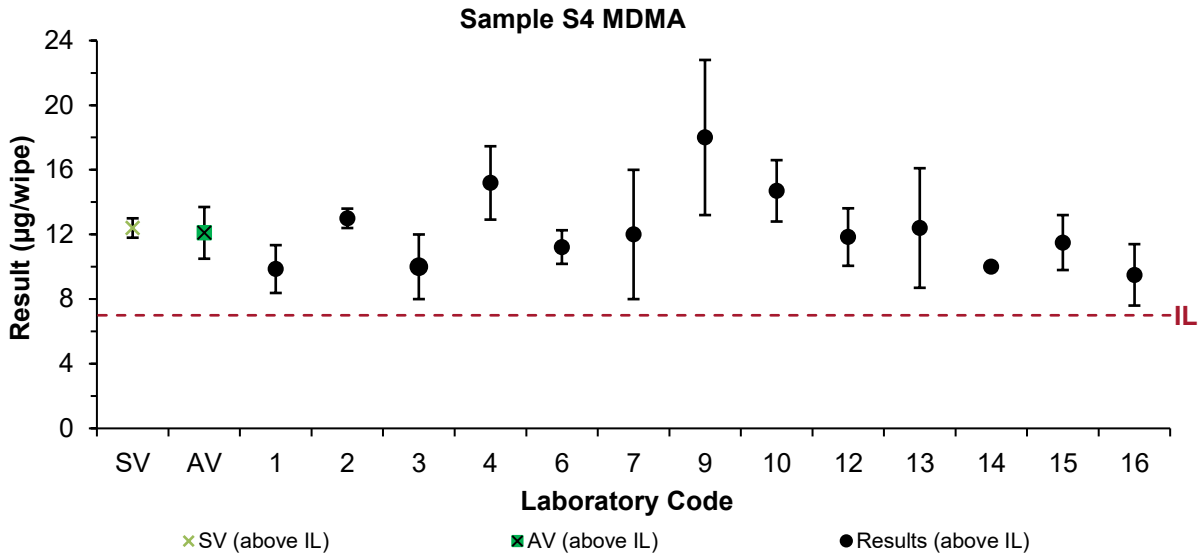


Figure 16 Sample S4 Spiked Value, Assigned Value and Participant Results

6.7 Summary of Participants' Results and Performances

A summary of participants' results and performances for scored analytes in this PT study are presented in Table 16.

Table 16 Summary of Participants' Results*

Lab. Code	S1 Methamphetamine	S2 Methamphetamine	S3 Methamphetamine	S4 MDMA
AV	0.364	1.38	2.30	12.1
SV	0.347	1.28	2.19	12.4
1	0.391	1.337	2.016	9.86
2	0.40	1.5	2.5	13
3	0.32	1.3	2.2	10
4	0.37	1.69	2.94	15.19
5	0.37	1.34	2.23	NS
6	0.317	1.241	2.081	11.22
7	0.4	1.5	2.2	12
8	0.347	1.26	2.26	NS
9	0.42	1.4	2.4	18
10	0.40	1.46	2.60	14.7
11	0.35	1.4	2.3	NS
12	0.354	1.449	2.659	11.84
13	0.35	1.4	2.1	12.4
14	0.7	1.5	2	10
15	0.31	1.27	2.28	11.5
16	NS	1.2	NS	9.5

*All results are given in µg base/wipe. Shaded cells are results which returned a questionable or unacceptable *z*-score. AV = Assigned Value; SV = Spiked Value.

6.8 Comparison with Previous Controlled Substances in Wipes PT Studies

NMIA has run five controlled substances in wipes PT studies. A summary of the participation and acceptable performance (presented as a percentage of the total number of scores for each study) obtained by participants in these studies (2018–2025) is presented in Figure 17. To enable direct comparison, the SDPA used to calculate *z*-scores has been kept constant at 20% PCV. Over these studies, *z*-score performance has remained very high at 97% acceptable *z*-scores on average. E_n-score performance has been lower at 80% acceptable E_n-scores on average, with this study also having the lowest percentage of acceptable E_n-scores across all studies; participants may be undervaluing their uncertainties.

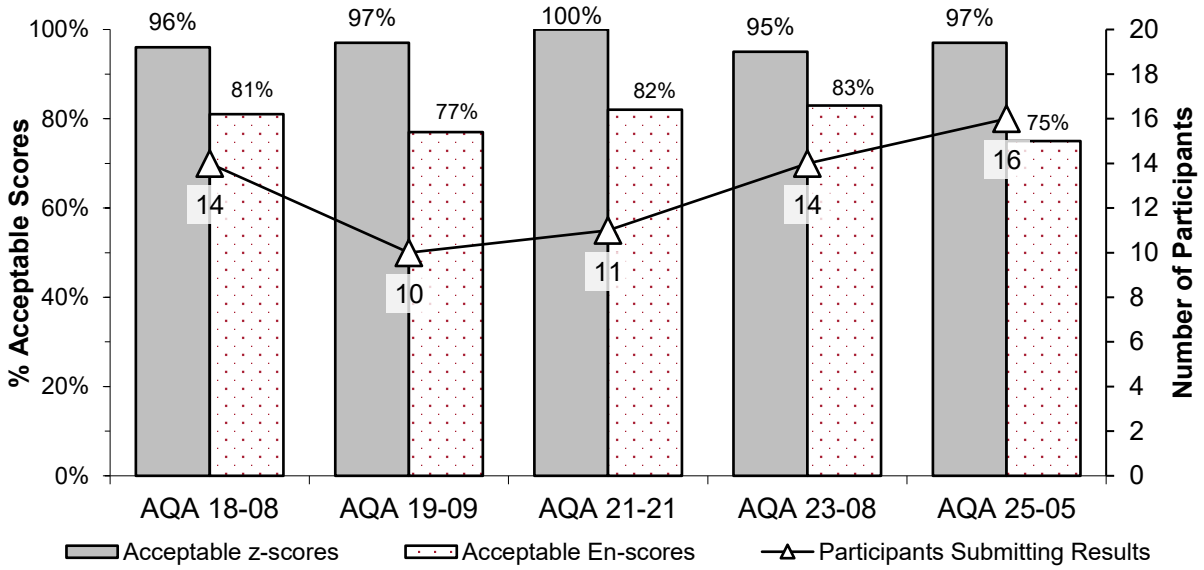


Figure 17 Summary of Participation and Acceptable Performance in Controlled Substances in Wipes PT Studies

Individual performance history reports are emailed to participants at the end of each study; the consideration of *z*-scores over time provides much more useful information than a single score. Over time, laboratories should expect at least 95% of their scores to lie 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.

7 REFERENCES

Please note that 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 competency of proficiency testing providers*.

[2] Commonwealth of Australia, 2011, *Clandestine Drug Laboratory Remediation Guidelines*.

[3] NMIA, 2025, *Study Protocol for Proficiency Testing*, viewed September 2025, <https://www.industry.gov.au/sites/default/files/2020-10/cpt_study_protocol.pdf>.

[4] NMIA, 2025*, Chemical Proficiency Testing Statistical Manual*, viewed September 2025, <https://www.industry.gov.au/sites/default/files/2019-07/cpt_statistical_manual.pdf>.

[5] 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.

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

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

[8] Eurachem/CITAC Guide CG 4, QUAM:2012.P1, *Quantifying Uncertainty in Analytical Measurement*, 3rd edition, viewed September 2025, <http://www.eurachem.org/images/stories/Guides/pdf/QUAM2012_P1.pdf>.

[9] NATA, 2020, Update to Measurement Uncertainty resources, viewed September 2025, <https://nata.com.au/news/update-to-measurement-uncertainty-resources/>

[10] NIOSH, 2011, *NIOSH Manual of Analytical Methods (NMAM)*, 5th edition, *Methamphetamine on Wipes by Liquid Chromatography/Mass Spectrometry NIOSH Method 9111*, viewed September 2025, <https://www.cdc.gov/niosh/docs/2014-151/pdfs/methods/9111.pdf>

[11] NIOSH, 2011, *NIOSH Manual of Analytical Methods (NMAM)*, 5th edition, *Methamphetamine and Illicit Drugs, Precursors and Adulterants on Wipes by Liquid-Liquid Extraction NIOSH Method 9106*, viewed September 2025, <https://www.cdc.gov/niosh/docs/2014-151/pdfs/methods/9106.pdf>

APPENDIX 1 HOMOGENEITY AND STABILITY

A1.1 Homogeneity

No homogeneity testing was completed for this study as the samples were prepared using a process demonstrated in previous NMIA PT studies to produce sufficiently homogeneous samples. The results of this study also gave no reason to question the samples' homogeneity. Comparisons of results for all scored analytes to sample number analysed by participants are presented in Figures 18 to 21. Results have only been included if the sample number was known (i.e. when the participant was sent only one sample set). No trend was observed.

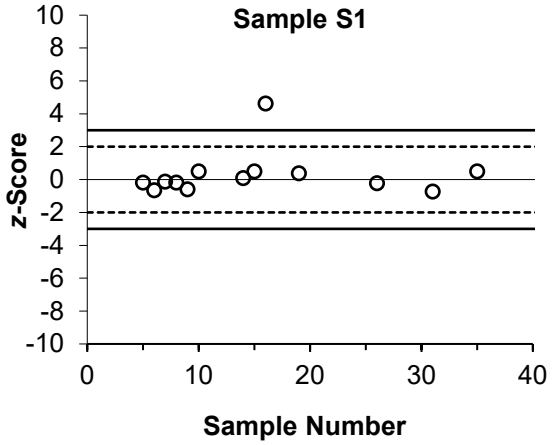


Figure 18 Sample S1 *z*-Score vs Sample Number

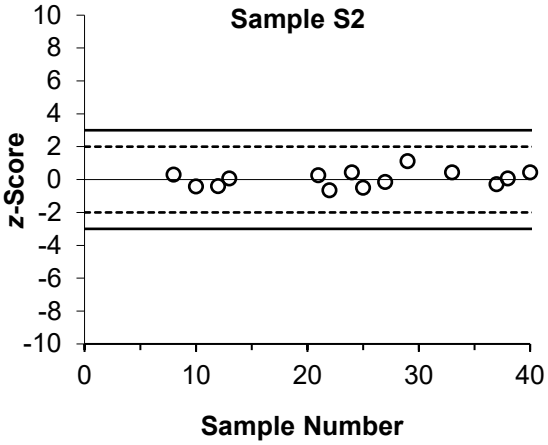


Figure 19 Sample S2 *z*-Score vs Sample Number

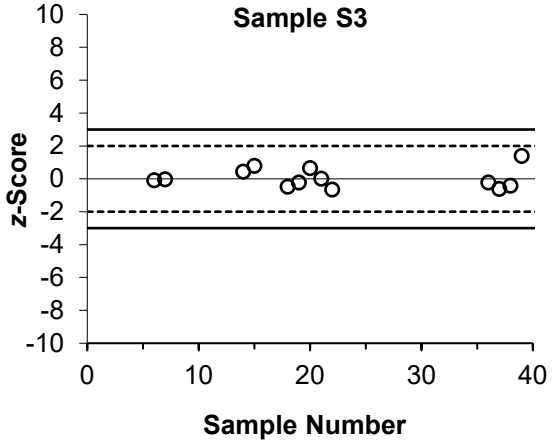


Figure 20 Sample S3 *z*-Score vs Sample Number

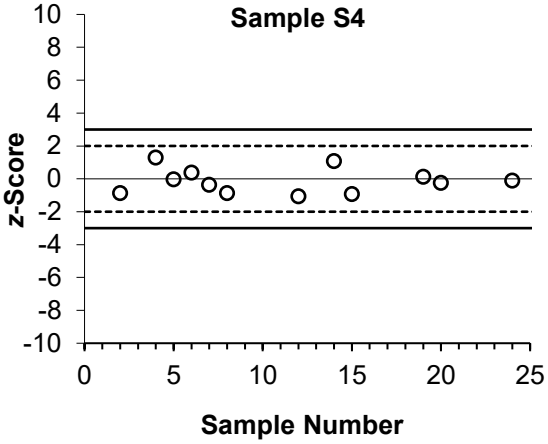


Figure 21 Sample S4 *z*-Score vs Sample Number

A1.2 Stability

No stability testing was conducted for this study as the process used to prepare, store and dispatch the samples was demonstrated in previous NMIA PT studies to produce sufficiently stable samples.

Samples were stored at 4°C after preparation and before dispatch. Samples were dispatched with ice bricks on 5 May 2025, and participants were advised to store the samples refrigerated if analyses could not be commenced on the day of receipt.

Days in transit, reported sample condition on receipt and date of analysis are presented in Table 17. All participants reported that their samples arrived in at least an acceptable

condition. All samples were delivered within seven days; ambient temperatures for this amount of time should not invalidate results, as supported by data from NIOSH.[10,11]

Table 17 Summary of Days in Transit, Reported Arrival Condition, and Analysis Date

Lab. Code	Days in Transit	Reported Arrival Condition	Date of Analysis
1	1	Acceptable	20/05/2025
2	1	Chilled	22/05/2025
3	2	Good	16/05/2025
4	1	Good	30/05/2025
5	6	Acceptable	09,11,14/07/2025
6	3	Good	23/05/2025
7	1	Fit for analysis	13/05/2025
8	1	Acceptable	9/05/2025
9	2	Good - But delay in delivery by courier	20/05/2025
10	3	Excellent	13/05/2025
11	1	Acceptable	16/05/2025
12	1	Acceptable	13/05/2025
13	1	Good	21/05/2025
14	7	OK	27/05/2025
15	1	Acceptable	5/06/2025
16	1	Chilled in box, jars sealed	29/07/2025

Comparisons of *z*-scores to the analysis date are also presented in Figures 22 and 23. No trend was observed.

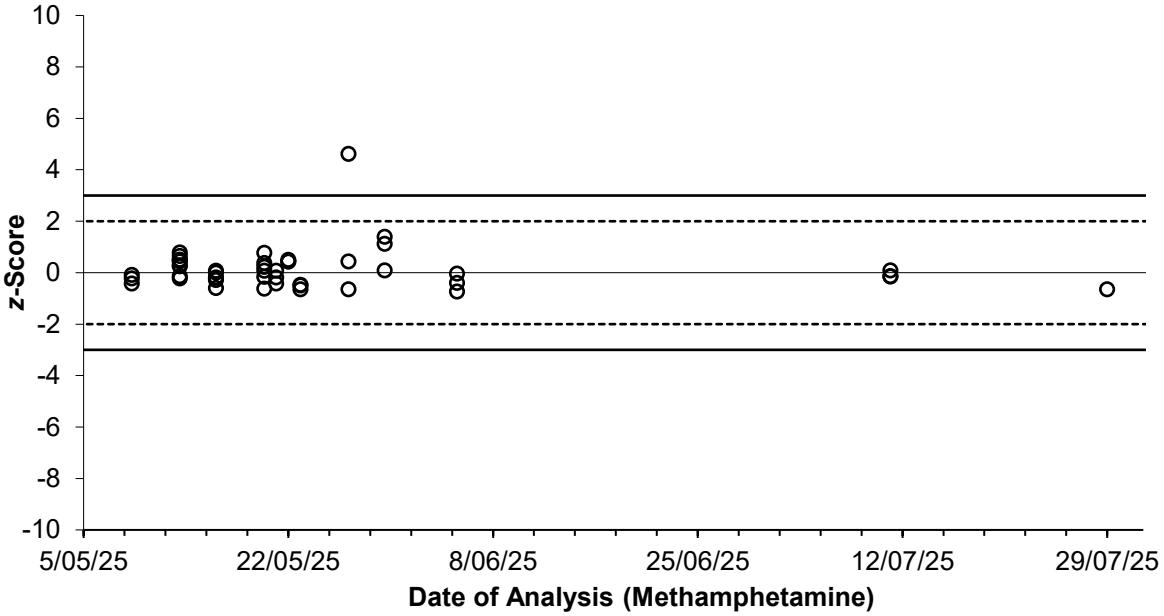


Figure 22 *z*-Scores vs Date of Analysis (Samples S1, S2 and S3 Methamphetamine)

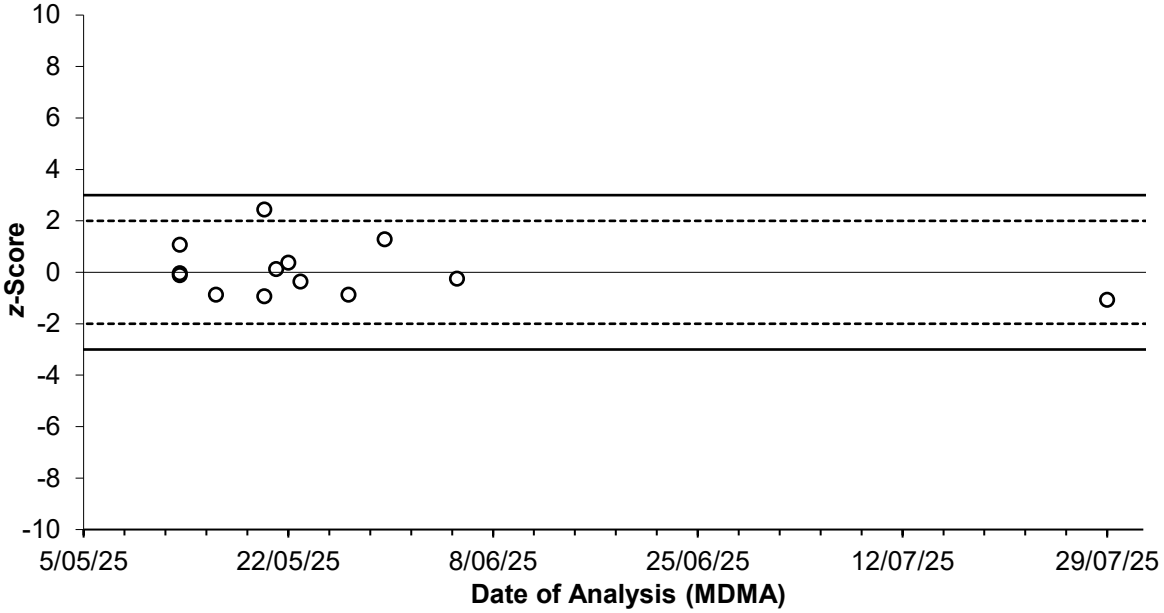


Figure 23 *z*-Scores vs Date of Analysis (Sample S4 MDMA)

APPENDIX 2 ROBUST AVERAGE AND ASSOCIATED UNCERTAINTY, *z*-SCORE AND E_n-SCORE CALCULATIONS

A2.1 Robust Average and Associated Uncertainty

When the robust average is calculated using the procedure described in ISO 13528,[6] the uncertainty is 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 18.

Table 18 Uncertainty of Robust Average for Methamphetamine in Sample S3

No. results (p)	15
Robust Average	2.30 µg base/wipe
$S_{rob\ average}$	0.25 µg base/wipe
$u_{rob\ average}$	0.08 µg base/wipe
k	2
$U_{rob\ average}$	0.16 µg base/wipe

Hence, the robust average for methamphetamine in Sample S3 is 2.30 ± 0.16 µg base/wipe.

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 19.

Table 19 *z*-Score and E_n-Score Calculation for Sample S2 Result Reported by Laboratory 12

Participant Result (µg base/wipe)	Assigned Value (µg base/wipe)	Standard Deviation for Proficiency Assessment	z-Score	E_n-Score
1.449 ± 0.217	1.38 ± 0.08	20% as PCV, or: 0.2 × 1.38 = 0.276 µg base/wipe	$z = \frac{1.449 - 1.38}{0.276} = 0.25$	$E_n = \frac{1.449 - 1.38}{\sqrt{0.217^2 + 0.08^2}} = 0.30$

APPENDIX 3 ACRONYMS AND ABBREVIATIONS

AV	Assigned Value
CITAC	Cooperation on International Traceability in Analytical Chemistry
CRM	Certified Reference Material
CV	Coefficient of Variation
DAD	Diode Array Detection
GAG	General Accreditation Guidance (NATA)
GC	Gas Chromatography
GUM	Guide to the expression of Uncertainty in Measurement
HPLC	High Performance Liquid Chromatography
IEC	International Electrotechnical Commission
IL	Investigation Level (Clandestine Laboratory Remediation Guidelines)
ISO	International Organization for Standardization
k	Coverage factor
Max	Maximum
Md	Median
MDMA	3,4-methylenedioxymethamphetamine
Min	Minimum
MS	Mass Spectrometry
MS/MS	Tandem Mass Spectrometry
MU	Measurement Uncertainty
N	Number of numeric results
NATA	National Association of Testing Authorities, Australia
NIOSH	National Institute for Occupational Safety and Health
NMIA	National Measurement Institute Australia
NR	Not Reported
NS	Not Supplied
PCV	Performance Coefficient of Variation
PT	Proficiency Testing
RA	Robust Average
Rec	Recovery
RM	Reference Material
SD	Standard Deviation
SDPA	Standard Deviation for Proficiency Assessment
SI	International System of Units
SS	Spiked Samples
SV	Spiked Value
UPLC	Ultra Performance Liquid Chromatography

END OF REPORT