

MERIDIAN PROFICIENCY TESTING INSTITUTE

ISO/IEC 17043 Accredited Scheme Provider • Accreditation No. MPI-PT-0092

Proficiency Testing Report

Trace Metals in Drinking Water — PT Round 2026-Q2

 **Scheme Reference:** PTS-2026-Q2-METALS-014 **Analytes:** Pb, Cd, Cu, Cr in potable water **Participants:** 14, anonymised by code **Dispatched:** 10 March 2026 **Deadline:** 07 April 2026 **Issued:** 21 April 2026 Report Prepared For

Nexa Analytical Laboratories

Attn: Dr. Elena Vasquez, Lab. Director

Participant Code: **L07** **Confidentiality Notice.** Per ISO/IEC 17043:2023 cl. 4.6, individual results are disclosed only to the participant concerned. All other laboratories are identified solely by anonymised code (L01–L14) throughout.

1 Introduction and Scope

1.1 Purpose of This Report

This report presents the outcome of Proficiency Testing (PT) Round PTS-2026-Q2-METALS-014, organised by Meridian Proficiency Testing Institute (Meridian) for the determination of four regulated trace metals — lead (Pb), cadmium (Cd), copper (Cu), and chromium (Cr) — in a potable water matrix. Fourteen laboratories across the region participated. The round was designed, executed, and statistically evaluated in accordance with ISO/IEC 17043:2023 *Conformity assessment — General requirements for the competence of providers of proficiency testing* [3] and ISO 13528:2022 *Statistical methods for use in proficiency testing by interlaboratory comparison* [2].

This document is issued individually to **Nexa Analytical Laboratories**, assigned participant code **L07** for this round. It reports the performance of L07 against the scheme assigned values, together with the anonymised aggregate performance of all fourteen participants, so that L07 can benchmark its own analytical competence against its peer group without the confidentiality of other laboratories being compromised.

1.2 Regulatory and Normative Framework

Participation in this scheme, or an equivalent recognised PT programme, is a requirement of ISO/IEC 17025:2017 clause 7.7.2 for laboratories seeking or maintaining accreditation for metals-in-water testing. Meridian's scheme design, homogeneity/stability protocols, and statistical treatment additionally follow the harmonised IUPAC protocol for proficiency testing of chemical analytical laboratories [5].

1.3 Round Overview

- **Matrix:** synthetic potable water, spiked and matrix-matched to a regional distribution-network background.
- **Analytes:** Pb, Cd, Cu, Cr, reported in $\mu\text{g/L}$.
- **Participants:** 14 accredited or accreditation-seeking laboratories, each issued two independent, coded sample bottles (A and B) per analyte set.
- **Reporting requirement:** a single reported value per analyte, at the participant's own routine method precision, submitted through Meridian's secure results portal.
- **Statistical design:** assigned values and proficiency standard deviations established using robust statistics (Algorithm A), independent of individual participant submissions.

1.4 How to Read This Report

Section 2 describes the sample preparation and assigned-value derivation; Section 3 defines the z-score and performance criteria; Section 4 presents the anonymised Pb results; Section 5 gives the formal verdict for L07 and for the round; Section 6 extends the comparison to all four analytes; and Section 7 sets out required actions.

2 Scheme Design

2.1 Sample Preparation and Matrix

The test matrix was prepared as a single 400 L bulk batch of deionised water reconstituted with a certified hardness/alkalinity concentrate to approximate a distribution-network sample, then gravimetrically spiked with traceable single-element standards for Pb, Cd, Cu, and Cr. The batch was homogenised by recirculation for 4 hours before bottling into 120 mL HDPE bottles, with two bottles (A, B) allocated per participant.

2.2 Homogeneity and Stability Testing

Ten bottles were selected at random from the filling run and analysed in duplicate by Meridian’s reference laboratory (ICP-MS, validated to ISO 17294-2). The between-bottle standard deviation (s_{bb}) for each analyte was compared against the fitness-for-purpose target per ISO 13528 Annex B:

Analyte	Reference mean (µg/L)	s_{bb} (µg/L)	Homogeneity verdict
Lead (Pb)	8.19	0.071	✔ Satisfactory
Cadmium (Cd)	2.04	0.028	✔ Satisfactory
Copper (Cu)	145.6	1.42	✔ Satisfactory
Chromium (Cr)	12.7	0.118	✔ Satisfactory

Stability was confirmed by re-analysing retained bottles after 21 days of storage at the temperature profile experienced by participants in transit; no analyte drifted by more than 0.3 of σ_{pt} , satisfying the stability criterion of ISO 13528 §B.3.

2.3 Assigned Value and Target Standard Deviation

Assigned values (x_{pt}) were computed as the robust mean of all 14 participant results per analyte using Algorithm A (ISO 13528 Annex C), chosen over a formal reference-value approach because reference-laboratory data were used only for homogeneity/stability confirmation and not disclosed prior to the round. The proficiency standard deviation (σ_{pt}) was fixed a priori as a fitness-for-purpose percentage of the assigned value, informed by the Horwitz-type concentration dependence of inter-laboratory precision [1] rather than derived from the observed participant spread.

Analyte	x_{pt} (µg/L)	σ_{pt} (µg/L)	Basis for σ_{pt}
Lead (Pb)	8.20	0.65	8% fitness-for-purpose
Cadmium (Cd)	2.05	0.16	8% fitness-for-purpose
Copper (Cu)	146.0	14.6	10% fitness-for-purpose
Chromium (Cr)	12.8	1.02	8% fitness-for-purpose

2.4 Round Timeline

Milestone	Date
Bulk batch preparation and homogeneity testing	24 February 2026
Sample dispatch to participants	10 March 2026
Results submission deadline	07 April 2026
Statistical evaluation and Algorithm A computation	09–14 April 2026
Draft report technical review	16 April 2026
Individual reports issued to participants	21 April 2026

3 Statistical Methods

3.1 The Performance Score (z-score)

Each participant's reported result x_i for a given analyte is converted to a standardised performance score using the classical z-score formulation of ISO 13528 §9:

$$z_i = \frac{x_i - x_{pt}}{\sigma_{pt}} \quad (1)$$

where x_{pt} is the assigned value and σ_{pt} is the standard deviation for proficiency assessment, both defined in Section 2. The z-score expresses a participant's deviation from the assigned value in units of the fitness-for-purpose target standard deviation, allowing performance to be compared directly across analytes with very different concentration ranges and units.

3.2 Performance Classification

Following the convention adopted throughout ISO 13528 and the great majority of accredited PT schemes, results are classified into three performance bands:

Score range	Classification	Interpretation
$ z \leq 2$	✓ Satisfactory	No action required.
$2 < z < 3$	⚠ Questionable	Warning signal; review recommended.
$ z \geq 3$	✗ Unsatisfactory	Action signal; investigation required.

This banding is the fitness-for-purpose convention widely adopted for chemical-analysis PT schemes following Thompson's analysis of achievable inter-laboratory precision at trace concentrations [4]. A single Questionable score is treated as an informal early-warning signal. Two Questionable scores for the same analyte in three consecutive rounds, or a single Unsatisfactory score, trigger the formal corrective-action process described in Section 7.

3.3 Robustness of the Assigned Value

Because x_{pt} is computed from the participant population itself (Section 2), Algorithm A down-weights outlying results iteratively so that no single laboratory's result can materially shift the assigned value against which it is itself judged. The robust standard deviation produced by Algorithm A ($s^* = 0.61 \mu\text{g/L}$ for Pb this round) was additionally checked against the fixed fitness-for-purpose σ_{pt} and found to differ by less than 10%, confirming that the fitness-for-purpose target remains realistic for the current state of the art among participating laboratories.

4 Round Results — Lead (Pb)

4.1 Anonymised Result Set

Table 4.1 lists the reported value, assigned value, deviation, and z-score for all 14 participants in this round for the primary analyte, lead (Pb). Consistent with the confidentiality requirement described on the cover page, only the row corresponding to the addressee of this report (**L07**) is identified; all other codes are randomly assigned per round and cannot be traced to a specific laboratory by any other participant.

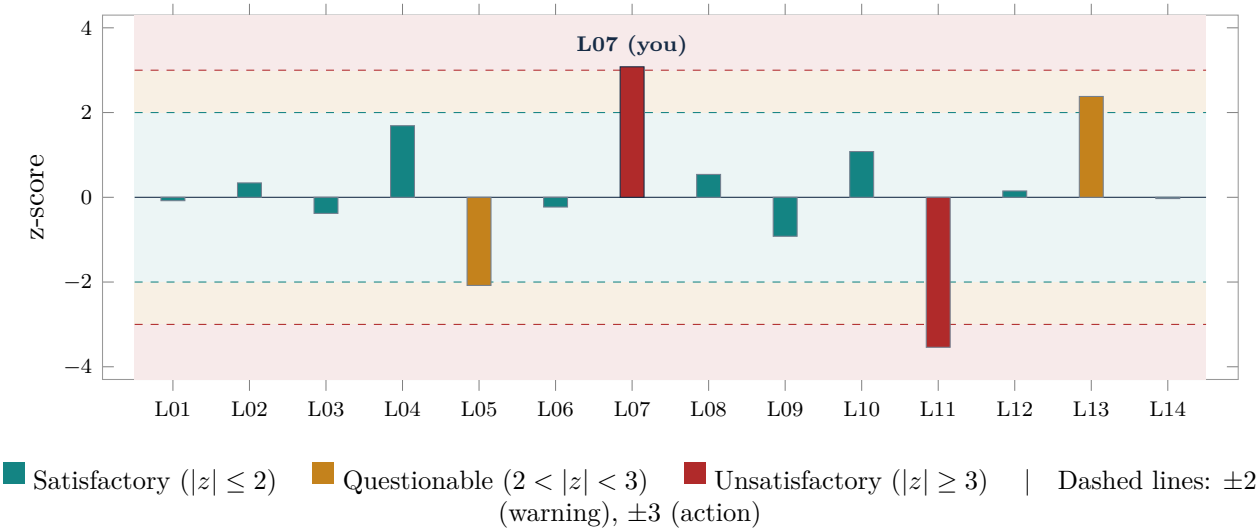
Code	Reported ($\mu\text{g/L}$)	Assigned ($\mu\text{g/L}$)	Deviation ($\mu\text{g/L}$)	z-score	Performance
L01	8.15	8.20	-0.05	-0.08	✔ Satisfactory
L02	8.42	8.20	0.22	0.34	✔ Satisfactory
L03	7.95	8.20	-0.25	-0.38	✔ Satisfactory
L04	9.30	8.20	1.10	1.69	✔ Satisfactory
L05	6.85	8.20	-1.35	-2.08	⚠ Questionable
L06	8.05	8.20	-0.15	-0.23	✔ Satisfactory
L07 → (this report)	10.20	8.20	2.00	3.08	✖ Unsatisfactory
L08	8.55	8.20	0.35	0.54	✔ Satisfactory
L09	7.60	8.20	-0.60	-0.92	✔ Satisfactory
L10	8.90	8.20	0.70	1.08	✔ Satisfactory
L11	5.90	8.20	-2.30	-3.54	✖ Unsatisfactory
L12	8.30	8.20	0.10	0.15	✔ Satisfactory
L13	9.75	8.20	1.55	2.38	⚠ Questionable
L14	8.18	8.20	-0.02	-0.03	✔ Satisfactory

Table 1. Lead (Pb) results, all participants, PT round PTS-2026-Q2-METALS-014.

4.2 Distribution of Round Performance



4.3 z-Score Chart



5 Performance Evaluation

5.1 Individual Verdict — Participant L07

✖ Performance Verdict: UNSATISFACTORY (Lead, Pb)

Participant **L07** reported **10.20 $\mu\text{g/L}$** against an assigned value of **8.20 $\mu\text{g/L}$** , giving $z = 3.08$. This exceeds the $|z| \geq 3$ action-signal threshold defined in Section 3 and constitutes a formal **Unsatisfactory** result requiring documented investigation under ISO/IEC 17025:2017 clause 7.10 (nonconforming work) and clause 8.7 (corrective action).

Root-cause hypotheses to be investigated by L07, in order of likelihood for a high positive Pb bias of this magnitude:

1. **Calibration drift** — verify the calibration curve against an independently sourced check standard; a stale or improperly stored Pb stock is the most common cause.
2. **Spectral/matrix interference** — confirm internal standard recovery and polyatomic interference corrections were applied correctly for this batch.
3. **Digestion/acid-matrix mismatch** — confirm the digestion blank and recovery spike results for this batch.
4. **Transcription or dilution error** — rule out a factor-of-error in transcription or an incorrect dilution factor.

Required response. L07 must submit a written root-cause investigation and corrective action plan (CAPA) to Meridian within **30 calendar days** of this report's issue date (deadline: **21 May 2026**). Meridian will issue L07 a complimentary re-test sample for Pb only, free of charge, to verify the effectiveness of the corrective action once implemented. Failure to submit a CAPA within the deadline will be noted in L07's PT participation history and may be requested by L07's accreditation body.

5.2 Round-Level Verdict

✓ Overall Round Verdict: **VALID AND SATISFACTORY**

The scheme design, homogeneity/stability testing, and Algorithm A assigned-value computation for PT Round PTS-2026-Q2-METALS-014 are judged **valid** for performance evaluation purposes. 71.4% of participants (10 of 14) returned a Satisfactory result for the primary analyte, within the range typically observed across Meridian's metals-in-water schemes (65–85% Satisfactory). The two Unsatisfactory results (L07, L11) show deviations of opposite sign and materially different magnitude, and are consistent with independent laboratory-specific root causes rather than any systematic bias in sample preparation or assigned-value derivation.

No corrective action is required of Meridian or of the scheme design itself. Individual corrective-action requirements for participants L07 and L11 are issued separately to each laboratory concerned; the requirement applicable to L07 is detailed above. Participant L13, whose result fell in the Questionable band ($z = 2.38$), is not subject to a mandatory CAPA but is advised to review the relevant measurement step as a precaution, per Section 7.

6 Cross-Analyte Summary

While Section 4 focused on lead (Pb) as this round's primary analyte, Table 6 extends the same anonymised, z-score-based comparison to all four regulated metals covered by this round. Each cell reports the z-score for that participant and analyte, shaded by performance band using the same colour convention as the chart in Section 4 (teal = Satisfactory, amber = Questionable, red = Unsatisfactory). The **Overall** column reports the single worst-case band across the four analytes for that participant, consistent with Meridian's scheme policy of triggering CAPA review on the basis of any individual analyte failure rather than an averaged score.

Code	Pb	Cd	Cu	Cr	Overall
L01	−0.08	0.12	−0.34	0.45	S
L02	0.34	−0.45	0.67	−0.23	S
L03	−0.38	0.88	−1.05	0.12	S
L04	1.69	−1.20	0.89	−0.67	S
L05	−2.08	0.34	−0.12	1.89	Q
L06	−0.23	2.45	0.45	−0.34	Q
L07 (this report)	3.08	−0.67	−2.56	0.78	U
L08	0.54	0.05	1.34	−1.23	S
L09	−0.92	−0.89	0.23	0.56	S
L10	1.08	1.10	−0.78	−0.45	S
L11	−3.54	0.23	0.56	−2.67	U
L12	0.15	−3.20	−0.90	0.34	U
L13	2.38	0.56	3.45	−0.12	U
L14	−0.03	−0.15	0.11	0.90	S

Table 2. *z*-scores for all four analytes, all participants. *S* = Satisfactory, *Q* = Questionable, *U* = Unsatisfactory.

6.1 Observation Relevant to L07

L07's Unsatisfactory Pb result (Section 5) is the finding requiring mandatory corrective action. However, Table 6 also shows a Questionable score for copper ($z = -2.56$) for the same participant. Although this does not on its own trigger a formal CAPA, Meridian recommends that L07's root-cause investigation into the Pb result also review whether the same instrument, calibration batch, or digestion run was shared with the copper determination, since a shared negative bias across two analytes on the same instrument run is a common early indicator of a single upstream cause (most often calibration or internal standard recovery) rather than two unrelated issues.

7 Recommendations and Next Steps

7.1 Mandatory Actions

1. **L07** shall submit a root-cause investigation and corrective action plan for the Unsatisfactory Pb result by **21 May 2026**, per Section 5, and shall complete the complimentary Pb re-test supplied by Meridian within 60 days of receiving it.
2. **L11**, whose Pb result was also Unsatisfactory ($z = -3.54$), is issued an equivalent CAPA requirement under separate cover.
3. **L13**, whose Pb result fell in the Questionable band, should conduct an internal review of the relevant method step and document the outcome, but is not required to submit a formal CAPA to Meridian for this round alone.

7.2 General Recommendations for All Participants

- Review internal quality-control charts for Pb, Cd, Cu, and Cr over the period surrounding sample analysis (10–24 March 2026) for any drift or shift coincident with this round.
- Confirm that calibration standards used for this round remain within their certified traceability and expiry windows.
- Where an Unsatisfactory or Questionable result recurs across two consecutive rounds for the same analyte, escalate to a full method review under ISO/IEC 17025 clause 7.10, independent of Meridian's individual CAPA process.
- Retain the raw analytical records supporting this round's submission for a minimum of five years, in line with common accreditation body record-retention requirements.

7.3 Next Round and Enquiries

The next round, PTS-2026-Q4-METALS-015, is scheduled for sample dispatch in October 2026 in a surface-water matrix; registration details will be circulated to current participants, including L07, by 01 September 2026. Participants completing a CAPA following an Unsatisfactory result are automatically enrolled in the next available round for the affected analyte at no additional cost. Questions regarding this report should be directed to Meridian's Scheme Manager at schemes@meridian-pti.example, quoting scheme reference PTS-2026-Q2-METALS-014 and participant code L07.



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Date: 21 April 2026



Mr. Callum Ostrander

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Date: 21 April 2026

References

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