

TBI-Forensic Services Division

Quality System Risk Assessment

Risk Assessment Code: RA-FC-New Balance Uncertainty Assessment-06-07-23
RA-Unit-Issue-Date

Assessed By: Lauren McCormick Date: 5/23/23

Issue to Assess: Evaluation of uncertainty of new balances with expanded readability

Laboratory/Discipline: Knoxville / Forensic Chemistry

Policy Referenced: Forensic Chemistry SOP Ch 14.2.1 and 14.4.5

Evaluation of Potential Risk:

Potential Impact on Quality System: High

Proposed Plan (list RCA and/or CAR codes if they were initiated):

Plan Assigned to: Lauren McCormick Date: 6/7/23

Plan Accepted: Yes
If no, why?

Technical Leader Signature: Brett Trotter

CLRS Signature: Kelvin Woodby
[Kelvin Woodby \(Jun 15, 2023 08:50 EDT\)](#)

Quality Assurance Manager: Chad Johnson
[Chad Johnson \(Jun 15, 2023 08:19 CDT\)](#)

New balances (Mettler Toledo model XSR4002S) were recently purchased that have a readability to the hundredths of a gram (0.01 grams) throughout their entire weighing range. This is opposed to current balances with a readability to the hundredths of a gram (0.01 grams) in their lower weight range and switching to a readability to the tenths of a gram (0.1 grams) in the higher weight range. Due to this difference in readability, the new equipment needed to be evaluated against our current uncertainty budget prior to use in casework.

Prior to the start of the study, each new balance was calibrated by an outside vendor, Precision Calibration Systems, on 5/25/23. Performance check data was collected 2-3 times a day for a week on each new balance in the Knoxville lab using a static weighing procedure. This was completed from 5/26/23 through 6/2/23 covering hours between approximately 7:30 am to 5:30 pm. Due to time limitations, this data does not cover a whole year's time span of data collections nor was it collected from the 2 other labs as previous uncertainty calculations have been. Multiple analysts (8) were included in this study including an intern, analysts in training, and analysts with varying years of experience. Each of the eight analysts completed at least one performance check on each balance. A total of 66 performance checks were performed per balance at the following weights: 0.10 grams, 0.50 grams, 5.00 grams, 50.00 grams, 1000.00 grams, and 2000.00 grams. Once this data was collected, the uncertainty of the new balances was calculated using the new balance calibration certificate uncertainty and new balance repeatability data with all other contributors remaining the same as the previous 2023 calculations.

	Calculated Uncertainty	Reported Uncertainty	Calculated Uncertainty	Reported Uncertainty
	0.01g readability or measurements less than 1000g		0.1g readability or measurements equal to or greater than 1000g	
Uncertainty for new balances	0.025g	0.03g	0.232g	0.30g
Previous 2023 Uncertainty	0.025g	0.03g	0.254g	0.3g

The results of these calculations are summarized in the table above. The uncertainty for the 0.01 grams readability range from previous 2023 calculations was 0.025 grams. For anything less than 1000 grams on the new balances, the uncertainty is also 0.025 grams. Since the calculated uncertainty values are the same, the reported uncertainty will stay the same at 0.03 grams with rounding. The uncertainty for the 0.1 grams readability range from previous 2023 calculations was 0.254 grams. For 1000 grams or greater on the new balances, the uncertainty is 0.232 grams. For rounding and consistency, the previous uncertainty for readability to the tenths of a gram was reported as 0.3 grams. As per policy 14.4.5, the number of decimal places in reported uncertainty should match the number of decimal places in the reported result. Because of this, uncertainty for the new balances with weights equal to or greater than 1000 grams will be reported as 0.30 grams. Due to no significant differences between the new balance uncertainty calculations and previous 2023 uncertainty calculations for top-loading balances, the new balances are deemed suitable for use in casework.



BILL LEE
Governor

TENNESSEE BUREAU OF INVESTIGATION

901 R.S. Gass Boulevard
Nashville, Tennessee 37216-2639
(615) 744-4000
Facsimile (615) 744-4500
TDD (615) 744-4001



DAVID B. RAUSCH
Director

MEMORANDUM

TO: The Forensic Chemistry Unit

FROM: Brett Trotter Special Agent Forensic Scientist Supervisor / Forensic Chemistry Technical Leader

DATE: 5/23/2023

SUBJECT: Mettler Toledo Balances (XSR4002S)

The Mettler Toledo XSR4002S balances have a readability that differs from our current dual-range balances. These balances have a readability to the hundredths of a gram throughout their entire measurement range. When making measurements with this model balance the analyst will include the measurement to the hundredths of a gram. However, the uncertainty of measurements will be three times 0.01 grams (0.03 grams) for measurement below 1,000.00 grams and three times 0.10 grams (0.30 grams) for measurements equal to or greater than 1,000.00 grams. Weekly performance checks will be conducted on these new balances in the same manner as our current dual-range top-loading pan balances with a tolerance of 0.01 grams below 1,000.00 grams and 0.1 grams equal to or greater than 1,000.00 grams for the check weights.

Brett Trotter SAFSS/TL



INTERNATIONALLY ACCREDITED SINCE 1994