Title: Weight Determination of Evidence

1. Introduction

Evidence that is in the form of powder, solid (e.g., rock-like), or plant material is usually weighed as part of the general scheme of controlled substance analyses. Analysts need to evaluate materials within case submissions in order to determine if criteria weights found within Connecticut (CT) statutes will be exceeded. Cases submitted for federal prosecution will be evaluated based on federal weight criteria.

If the amount of evidence to be weighed, including the weight of the packaging material, does not meet or exceed criteria weight, the item's weight (both evidence and packaging) can be obtained by directly measuring the mass of all evidentiary material. In the case of multiple items wherein all items are visually indistinguishable, taking a gross weight of the evidence and subtracting-out the weight of packaging material is acceptable.

Uncertainty measurements are considered for all cases where weights are taken and reported.

2. Scope

This procedure describes the weighing process and reporting criteria for controlled substances and related evidence. This procedure can also be used when weight measurements on evidence will not be reported but when they are simply listed within case notes. Reported weight measurements wherein approximations are given (e.g., Item 001-01 weight approximately 10.5 grams) can have associated uncertainties reported also, however listing them in reports may cause confusion. This procedure is designed for analysts who determine weights for evidentiary material.

3. Principle

This procedure involves the weighing of evidentiary specimens using electronic analytical balances. The following definitions will be helpful when following this procedure:

Like-items: Materials within submissions which are, in a general sense, visually indistinguishable from one another.

Primary packaging: Material directly containing evidence to be analyzed (e.g., plastic bags that contain drugs).

Criteria Weight: a measurement that, when reached or exceeded, may influence the penalty imposed during sentencing (state or federal) for controlled substances.

Gross Weight (aka. Weight with Packaging): a measurement where samples are weighed with their primary packaging.

Direct Weight: A measurement determined by weighing an item(s) without packaging.

Calculated Net Weight (aka. Net Weight): A measurement resulting from a calculation which is determined by subtracting two measured values (e.g., weights from item(s) with packaging and weights from packaging).

This is often used within cases that have multiple like-items and criteria weights may be exceeded. Calculated net weight is synonymous with the term, net weight, which may be found within certain forms or worksheets. Calculated net weight is determined by:

Calculated Net Weight = Gross Weight – [(average weight of packaging) x (number of packages)]

Measurement Uncertainty (of reported weight(s)): a value which is associated with a particular balance and which describes the dispersion (or uncertainty) of the weight value(s) being reported.

Dynamic Weight: a measurement obtained by placing a weighing container on a balance, taring the balance to zero, and then placing the item(s) to be weighed within the weighing container. For example, weighing paper is placed on a balance's pan, the balance is tared to zero, items are placed on the weighing paper, and a final weight is obtained. The weighing container need not remain on the balance during transfer of items onto the container. Dynamic weight measurements are considered one (1) weighing event.

Static Weight: a measurement obtained by subtracting two (2) weight measurements. For example, the weight of a weighing container is subtracted from the weight of a weighing container plus the item to be weighed. This can be done by obtaining the mass of a weigh-boat and recording that weight. The item to be weighed is then placed on or in the weigh-boat and the combined weight is then measured and recorded. The weight of the item in question is obtained by subtracting the two recorded weights. Static weight measurements are considered two (2) weighing events.

4. Specimens

Any solid or liquid can be used in this procedure. Generally only weights from solids (e.g., powders, pills, tablets, rock-like materials) and certain vegetative materials (e.g., suspected marijuana) will be measured and listed within reports. Weighing techniques can either be direct or indirect depending on the sample submission and the information required to be reported.

5. Equipment/Materials/Reagents

5.1 Analytical balances (top-loading, analytical or equivalent)

5.2 Masses (Troemner or equivalent)

5.3 Weigh paper/boats (or equivalent)

5.4 Other common laboratory equipment (e.g., tweezers, spatulas, etc.)

6. Calibrators and Controls

Certified weights will be used when performing weight measurement checks for the analytical balances unless situations warrant other materials to be utilized (e.g., simulated powders within Powder-Safe hood). All items being weighed will be handled using appropriate utensils or gloved hands. When using gloves to directly handle weights, cotton (not polymeric) gloves should be used.

Masses used for checking balances (e.g., daily balance checks) will have been certified according to applicable policy (i.e., General Lab (GL)).

7. Procedure

7.1 Daily checks: Balances will be checked for accuracy prior to daily use. The term 'daily' refers to the day a balance is actually used for a collecting a measurement. Each day a balance is used it is checked with at least one (1) certified mass. The check is logged into the appropriate balance log book (see CS-5.4). The acceptable ranges for each certified mass are kept with the balances.

7.2 Analysts should select masses that are close to the approximate weight of the material to be weighed. It is not unreasonable for an analyst to check several masses.

7.3 Analysts will select a balance appropriate to the task being performed. The basis of this selection should include range of the balance and relative weights of sample materials.

7.4 It is preferred to use balances that capture data directly onto an electronic device so as to avoid transcription errors.

7.5 Balance Use:

7.5.1 Each balance has on/off and tare function keys.

7.5.2 Use appropriately sized weigh paper/boat on the balance platform. Tare using the tare function key.

7.5.3 If there is drift (i.e., the instrument is unstable and will not zero or maintain a zero reading) and a simple fix can't be performed (e.g., airflow, abnormal vibrations), the analyst will not use the balance. The appropriate Lead Examiner (or higher) will be notified and the balance may need to be placed out-of-service.

7.5.4 If the balance has been moved (either accidentally or deliberately), the instrument should be checked against certified masses. A low, medium, and high mass should be used. The instrument is acceptable if the measured masses are within the accepted ranges that are with each instrument. Balances should not be moved without prior authorization from the appropriate Lead Examiner (or higher).

7.5.5 Analysts using balances will ensure that they are clean before and after each use as well as in-between sample weighing events. Methanol or similar solvent can be used for cleaning purposes. The analyst will ensure that all solvents used for cleaning will have thoroughly evaporated prior to taking measurements.

7.5.6 Analysts should not place any evidentiary items directly on the weighing pan. Clean weigh paper, weighing boat, or other clean container will be used for each weighing measurement.

Note: Weigh paper/boats are not used when using certified weights.

7.6 Weighing Considerations:

7.6.1 Analysts will determine the best approach for obtaining weight(s) of evidence (i.e., direct weights, net weights, gross weights).

7.6.2 Net weights for evidence involving overdose-type cases are not required and gross weights should be reported in those situations. If there are any questions then the appropriate Lead Examiner (or higher) should be consulted for direction.

7.7 Direct Weights:

7.7.1 A weighing container is placed on a balance and the balance is tared to zero.

7.7.2 The item (e.g., rock, powder, plant material) is placed in the tared container and the weight is recorded.

7.7.3 Weights should be recorded with no fewer than two (2) decimal places, when possible.

Note: Evidence in the liquid form are not routinely weighed unless specifically requested.

7.8 When calculating direct weights all digits should be used in the calculations and the final result will have digits appropriately truncated.

7.8.1 If a criteria weight (i.e., weight listed within a regulation/statute which differentiates penalties) is reached and exceeded by 20%, then a direct weight will be obtained at that point. Any excess evidence of the same type will have their weights be reported as gross weight (i.e., with packaging), unless specifically requested to do otherwise.
The weight to be reported can be a calculated net weight in submissions that have greater than six (6) like-items. For cases with six (6) or less like-items, or for non-like-items, single (or several single) direct weights can be obtained.

7.8.2 For cases that contain suspected marijuana evidence which has a weight that meets or exceeds six (6) ounces (170.1 grams), then only direct weights (i.e., weights without packaging) will be obtained at that point. Any excess evidence (i.e., over the 6 ounces) of the same type will have their weights be reported as gross weight (i.e., with packaging), unless specifically requested to do otherwise. Analysts can consult with the Lead Examiner (or higher) to determine if it is necessary to report marijuana submission weights when such weight is under 1.8 ounces.

Note: The 'meets or exceeds six (6) ounces' is used because that weight is 20% greater than the maximum amount of marijuana currently allowed under CT statute and/or regulation (see Public Act 21-1). The 1.8 ounces was used because it is 20% greater than the 1.5 ounces limit.

7.8.3 If the criteria weight for an item of evidence (or group of similar items within a submission) exceeds 20% of the criteria weight for a drug, then direct weights of the remaining item(s) is not required. Gross or calculated net weights will be obtained and subsequently reported for the remaining item(s) that account for the 20% weight overage. Consult the appropriate Lead Examiner (or higher) if guidance is needed on how to report the weights.

Note: If specifically requested by the customer and/or necessary, net weights for evidence will be obtained.

7.8.4 If a criteria weight won't be met or exceeded then a gross weight (weight with packaging) can be taken. In cases where samples have multiple packages (or bags) of evidence the

analyst may need to ensure that the proper measurement is taken by performing a calculated net weight.

7.8.5 For all multiple like-item submissions, the weight of items that are analyzed will be determined and reported. If the item is reported with packaging, then any sub-items can be reported with packaging. If the item is reported without packaging (net weight), then any sub-items should be reported using direct weight.

7.8.6 Uncertainty must also be taken into account when determining how to approach weighing the items in a case (see CS-5.1). Weight worksheets contain uncertainty determination sections and calculations (see CS-5.2 and 3).

7.8.7 Uncertainty information is available and values should be located at each balance.

If a measurement is obtained for a direct weight or calculated net weight and it is either required or requested by the customer then it will be reported. In some cases it may be necessary to combine several items and take a combined weight for the quantitation.

7.9 Gross Weight: A weigh container is placed on the balance and the balance is tared to zero. The material is placed in the tared weigh container with its packaging and the gross weight is recorded. This should be recorded with the appropriate number of decimal places based on the uncertainty of the balance used. When performing a weight with packaging, only the smallest packaging possible should be included. Do not include the evidence bag with the weight of the packaging.

Example: If six (6) zip-lockable bags of plant material are submitted in a paper bag, and the paper bag is found inside a plastic evidence bag, the weight of the plastic evidence bag and the paper bag will not be included in the overall weight measurement.

7.10 Calculated Net Weight: a weighing container is placed on the balance and the balance is tared to zero. Like-items are placed in the tared weighing container and the gross weight of the like-items is recorded on the Net Weight Worksheet (CS-5.2). Five (5) representative specimens of the like-items are then randomly chosen and all of the weights (contents and packaging) are recorded on the same worksheet. Each primary packaging (e.g., bag) is separately emptied, individually weighed using tared weigh containers, and the [empty packaging] weights are recorded. If the [empty] primary packaging weights do not vary by more than 25% from the average empty-packaging weight, then the approximate calculated net weight due to all the primary packaging in the submission will be recorded.

7.10.1 Calc'd Net Weight = Gross Weight – [(avg. empty-package weight) * (# of packages)]

7.10.2 If the empty-primary packaging weights vary by more than 25% of the average empty-primary packaging weight, more weights will need to be taken unless directed otherwise by a Lead Examiner or higher. Generally five (5) additional empty-packaging weights will be obtained. If these weights are consistent with one another and don't vary by more than 25% of the previous average empty-packaging weight, then the new average will be based on the total (e.g., 10) readings.

7.11 Dynamic Weight: This measurement is obtained by taring to zero a weighing container and then placing the item to be weighed either within or on the container in order to get a resulting weight value. This will be done by placing a weighing boat on a balance and taring it to zero. The item to be weighed is then placed in the weighing boat and a weight value is obtained. Dynamic weight measurements are considered one (1) weighing event.

7.12 Reporting:

7.12.1 Weights: Weighing measurements will be limited to a maximum of two (2) decimal places unless doing so would cause uncertainty values of 0.00 to be reported. If this happens then more decimal places can be used. For example, a balance with an expanded uncertainty of 0.005g would cause measurements to be reported as '+/- 0.00g' if only two decimal places were used. In these cases the weights will be reported to three (3) decimal places (e.g., '+/- 0.005g').

7.12.2 Reported weights will be truncated and not rounded.

Examples: a) When reported in kilograms: 1025g will be reported as 1.02kg
b) 0.1578 grams will be reported as 0.15 grams

7.12.3 Measurement Uncertainty: When measurements are reported measurement uncertainty values associated with such weight values will also be reported.

7.12.3.1 Expanded measurement uncertainty values will be reported to a 95.45% level of confidence and will be reported to the same number of decimal places as the weight measurement.

7.12.3.2 The following format will be used within reports:

Weight +/- Expanded Uncertainty (same units and decimal places)

7.12.3.3 Only one (1) measurement unit uncertainty is required to be reported.

7.12.3.4 If a weight measurement is reported in both grams and ounces it is permissible to only report the measurement uncertainty of the corresponding weight in grams, not in both grams and ounces.

Report Writing Examples:

Item #001-01: weighed 100.523 grams (3.545 ounces) +/- 0.004 grams

Item #001-02: weighed 150.52 grams (5.30 ounces) +/- 0.03 grams

8. Calculations

8.1 Ounces to pounds: divide the number of ounces by 16.

8.2 Grams to ounces: divide the number of grams by 28.35

8.3 Net Weight = gross weight – (average packaging weight x number of primary packages)

8.4 Weight variation (25% for packaging): 0.25 x (average primary packaging weight)

9. Sources of Error

9.1 Failing to tare a balance or weigh boat before adding the sample.

9.2 Failing to clean the balance before or after use.

9.3 Failing to change the weigh boat/paper in-between samples.

9.4 Improper calculation of weights.

9.5 Failing to subtract all of the packaging weights (or calculated packaging weights) that were included in the gross weight for net weight determination.

9.6 Sample loss during transfer into a weighing device will cause a smaller weight to be reported.

10. Safety

Appropriate PPE (personal protective equipment) must be worn when handling drug evidence and includes at least a lab coat, gloves, and safety glasses. Additional equipment such as masks should be worn, when appropriate. Items that are submitted into the Unit can contain a variety of potentially harmful substances, some of which may be directly absorbed through the skin and some which may easily be aerosolized and inhaled.

11. References

11.1 State of Connecticut Controlled Substance Laws. State of Connecticut Department of Consumer Protection Controlled Drug Schedules, Violations & Penalties:
(e.g., ControlledDrugSchedulesViolationsPenaltiespdf.pdf (ct.gov)

11.2 Federal Controlled Substance Trafficking Penalties
(e.g., https://www.dea.gov/sites/default/files/drug_of_abuse.pdf)

Appendix:

Situation #1 - Everything passes on first five (5) weighing events:

Weighing Event	Measurement	|Measurement-Average|	25% Difference from Average
1	66	12	**Pass**
2	55	1	**Pass**
3	52	2	**Pass**
4	50	4	**Pass**
5	49	5	**Pass**
Ave.	**54**		
Average x 0.25	**13.6**		

Situation #2 - First five (5) weighing events result in greater than 25% variance:

Weighing Event	Measurement	|Measurement-Average|	25% Difference from Average
1	70	15	**Fail**
2	55	0	**Pass**
3	52	3	**Pass**
4	50	5	**Pass**
5	49	6	**Pass**
Ave.	**55**		
Average x 0.25	**13.8**		

Weighing Event	Measurement	|Measurement-Average|	25% Difference from Average
6	66	11	**Pass**
7	69	14	**Pass**
8	65	10	**Pass**
9	55	0	**Pass**
10	48	7	**Pass**
Ave.	**61**		
Average x 0.25	**15.2**		

Rev. #	History
5	Changed title. General verbiage changes throughout document. Section B: Changed 'Variance' to 'Coefficient of Variation' and removed 'Average Deviation.' Section D: Made in-house validation of equipment optional, re-worded procedure that GL policy will be followed for equipment calibrations, and clarified responsibilities. Section E: corrected calculation equations. Changed definition of timeframe for accuracy check of equipment to refer to GL policy. Replaced supervisor with Lead Examiner. Clarified verbiage throughout document. The use of 'shalls' and 'shoulds' were re-evaluated and changed accordingly. Frequency of uncertainty calculations no longer specifically stated.
6	Updated 'Net Weight' to be more accurately listed as 'Calculated Net Weight'. Defined like-items. Defined measurement uncertainty of weight reporting. Clarified dynamic weight and static weight. Updated the safety section. Removed CS section and replaced with 'Unit.' Defined acronyms. Case materials replaced with associated packaging. 'Applicable policy' added to Procedure section. Minor grammar and formatting changes. Added that certified weights can be weighed directly on a weighing pan. Removed uncertainty determination verbiage since it is covered within another SOP. Clarified the reported expanded uncertainty as having a confidence level at 95.45%
7	Updated Section E with more description. In Section F the requirement of a witness to an evidence weighing event was removed. Added measurement uncertainty wording (Section F. 5.) when reporting multiple units (grams versus ounces) within reports. Updated drug trafficking criteria weight web link within the References section.
8	Major format change throughout document. Updated Section F-5 to follow ANAB standard AR3125 (7.8.3.1.C.1) where only two (2) significant digits will be reported within measurements unless there's a valid reason for not doing so. Changed section G-4 regarding how to calculate whether packaging weight variation is greater or less than 25% variability of average weight. Added examples within Appendix for average weight variability determination.
9	Minor addition within Section 1. Removed specific balance model/make information within Section5. Updated Section 6 to include non-certified weights when necessary. Updated Section 7.8 and sub-sections. Updated Section 7.12.1 to clarify significant digit definition. Added 'measurement' within Section 7.12.4.
10	Added guidance for overdose-type cases within Section 7.6. Added exception to the requirement of obtaining weights for evidence exceeding criteria weights in Section 7.8. Minor grammatical changes throughout document. Updated section 7.5 to include 'appropriate' Lead Examiner, changed ethanol to methanol, replaced 'significant figures' with 'decimal places.'. Added 'regulations' to statutes. Updated section 7.8.2 to be in

line with new marijuana legislation. Updated sections 7.11 and 7.12. Updated requirement for safety gear when analyzing evidence to include lab coat and safety glasses. Updated the website link within Section 11. Replaced the term 'significant digits' with 'decimal places' throughout document. Replaced the word, 'bag' with 'primary packaging' or 'packaging.' Added a title line to the beginning of the document. Updated specimen types in section 4.