A. **PURPOSE**:

Evidence that is in the form of powder, [rock] solid, or plant material is weighed as part of case analysis. Analysts need to evaluate case materials to determine if Connecticut (CT) state law criteria weights will be exceeded. Cases submitted for federal prosecution will be evaluated based on federal weight criteria.

Weight can be determined by; taking the direct weight of the material, taking the weight with packaging (if a criteria weight will not be met) or in the case of multiple like items, by taking a gross weight and subtracting the packaging weight.

Uncertainty of measure is considered for cases where the substance identified has a criteria weight either, state or federal, associated with it.



B. **RESPONSIBILITY**:

All Forensic Science Examiners (FSE) and analysts who determine weights for evidentiary material.

C. **EQUIPMENT:**

Mettler AT-261
Mettler PE 300
Mettler-Toledo AG
Denver Instrument TR-603d
Denver Instrument TR-603
Mettler-Toledo XS203S
Ohaus Discovery DV215CD
Other analytical balances
Troemner Masses (or other certified masses)

D. **DEFINITIONS**:

**Net Weight**: This is calculated for cases with multiple like items where a criteria weight may be exceeded. It is calculated as:

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

**Direct Weight**: This is determined by weighing the item(s) without packaging.

**Gross Weight**: This is determined by weighing the item(s) with packaging.

**Uncertainty of Measure**: a parameter characterizing the dispersion of the values attributed to a measured quantity.

**Criteria Weight**: a weight of a controlled substance when reached or exceeded which may influence the penalty imposed during sentencing (State or Federal).

**Dynamic Weight:** a weigh container is placed on the balance and tared. The item to be weighed is placed directly on the weigh container (without removing it from the balance platform) and the weight is recorded. This represents one weighing event.

**Static Weight:** a weigh container is placed on the balance and tared. The container is removed from the balance, the item is added to the container and the combined are placed on the balance to obtain the weight. This represents two weighing events.

E. **SAFETY**:

Proper protective devices must be worn when handling drug evidence; this includes gloves and a lab coat. Items that are submitted can contain a variety of substances some of which may be directly absorbed through the skin (including, but are not limited to PCP and LSD).

F. **PROCEDURE**:

Weights for case materials will be taken in the presence of a witness.

1. Controls:
    a. Annual: balances are checked for accuracy by a contracted vendor. The vendor will be ISO 17025 certified or equivalent. The documentation shall be maintained with the Quality Manager.
    b. Masses are ANSI/ASTM class 1 masses or ultra-class. These masses are used for the daily balance checks.
    c. Daily checks: Each day a balance is used it is checked with at least one certified mass/weight. The check is logged into the balance log book for the specific balance used (see CS-5.4). The mass/weight that is used to check the balance must give a weight that is ±1% of the reported weight that is used. If the weight is outside the acceptable ±1% limit, then the balance should not be used until either a Lead Examiner or Deputy Director is notified and the issue is resolved. The analyst should select a mass/weight that is close to the approximate weight of the evidence that is to be weighed. It is reasonable for several masses/weights to be used in the balance check when evidence involves various weight ranges. It is also acceptable for the balance check to be performed after the evidence is weighed, so that appropriate weights/masses can be selected.
    d. The analyst will select a balance appropriate to the task being performed, the basis of this selection is the range of the balance, relative to the weight of the sample materials.

e. When applicable, it is preferred to use balances that capture data electronically (i.e., directly onto a computer application or onto a printer) in order to avoid transcription errors.

2. Balance Use:

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

   b. An appropriately sized weigh boat placed on the balance platform is tared using the tare function key.

   c. When using a balance if there is drift (the instrument is unstable and will not zero or maintain a zero reading) the analyst must not use the balance and should notify the Lead Examiner. This is usually due to room conditions, abnormal vibrations or air flows; the analyst can try another balance or wait to a later time to see if the balance stabilizes

   d. If the balance has been moved (either accidentally or deliberately) the instrument should again be checked against the certified masses. A low, medium and high mass will be used, the instrument is acceptable if they are within the accepted ranges (posted with each instrument). Balances should not deliberately moved with out prior authorization from the Deputy Director or the Quality Section.

   e. Balances should be cleaned after use and between samples: This ensures there is no contamination from case materials. An appropriate solvent should be used (e.g., methanol, ethanol). When possible, analysts should not place any items directly on the weighing pan. A clean weigh paper or weight boat should be used for each weighing event.

3. Sample Considerations:

   Analysts determine the best approach to obtaining mass/weights of evidence.

   i. If a criteria weight can be meet or exceeded a direct weight needs to be performed. This can be a calculated net weight in the case of greater then 6 like items or a single or several direct weights for cases with 1 to 5 like items. (See CS-5.1)

   ii. As of July 1, 2011 CT put into effect Public Act 11-71. This act reduces the penalty for the possession of marihuana under 0.5 ounces. Due to this change, when the weight of marihuana evidence approaches or exceeds 0.5 ounces, it must be reported with a direct weight (i.e., weight without packaging).

   iii. When specific case circumstances are known (e.g., the charge is violation of probation or there are multiple drug submissions), the analyst should consult with a Lead Examiner or with the Deputy Director in order to determine if it is necessary to report marihuana submissions with direct weights. When this is done, it will be documented in the case notes.

   iv. If a criteria weight will not be approached or exceeded, a gross weight (weight with packaging) can be taken. Note that the analyst must prove that the criteria weight will not

be exceeded. In the case of multiple bags of drugs, or similar situatuations, the analyst may need to prove this by performing a calculated net weight.

v. For all multiple like item submissions, the weight of any items analyzed will be determined and reported. In general 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 the direct weight.

vi. Uncertainty must also be taken into account when determining how to approach weighing the items in a case. Weight work sheets contain uncertainty determination sections and calculations (see CS-5.2 and CS-5.3).

(a) When a criteria weight can be meet or exceeded direct weight or net weight is required.

(b) When a weight with packaging is approaching (not just exceeding) a criteria weight a direct weight or net weight may be required.

vii. Uncertainty for each balance is recalculated as required. The calculations will be reviewed by an appropriate Lead Examiner or Deputy Director prior to be being put in use. In general, the factors used to determine the uncertainty associated with a balance are:

(a) Readability (this is per manufacturer's specifications)

(b) Repeatability (based on the performance of the balance using certified masses)

(c) Linearity (this is per manufactured specifications)

(d) Uncertainty of the balance

(e) Environmental factors (temperature, humidity – these are considered insignificant and are caught in the repeatability performance)

(i) Number of Weighing Events – (this will be different for each case)

(ii) Placing a weigh container on a weigh pan, taring the balance then adding the substance and recording the weight is one weighing event (dynamic weighing event).

(iii) A weigh container is placed on the balance and tared. The container is removed from the balance, the item is added to the container and the combined are placed on the balance to obtain the weight. This represents two weighing events (Static weighing event).

(f) Sample loss due to transfer (this can be very significant however this cannot be captured due to the nature of the case work)

4. Method:
   a. Direct Weight: a weighing container is placed on a balance and tared; the case item (rock, powder, plant material) is placed in the tared container and the weight is recorded in the case documentation (possible appropriate forms include CS-1.1, CS-1.2, CS-5.2 and CS-5.3). This will be recorded with no fewer than 3 significant figures whenever possible.
   b. Weight with packaging: a weigh container is placed on the balance and tared. The case material is placed in the tared weigh container with the packaging , the weight is recorded in the case documentation (possible appropriate forms include CS-1.1, CS-1.2, CS-5.2 and CS-5.3) . This will be recorded with no fewer than 3 significant figures whenever possible.
      i. Note when performing a weight with packaging the analyst will only include the smallest packaging possible. Weight with packaging, will never include the evidence bag weight.
         (a) Example: if 6 zip lock bags of plant material are submitted in a paper bag inside an evidence bag the weight of the evidence bag and the paper bag will not be included in the weight.
   c. Net Weight: a weigh container is placed on the balance and tared. The like items are placed in the tared weigh container and the gross weight is recorded on the NET WEIGHT WORKSHEET (CS-5.2) under gross weight of items. Five bags (items) are then randomly chosen and the following is done (all weights are recorded on the same worksheet): each bag is separately emptied onto individual tared weigh containers and the weights are recorded, the weight of the empty bag is taken and recorded. If the bag weights do not vary more than 25% from the average bag weight the net weight can be calculated.
      i. Net Weight = gross weight – (average bag weight x number of packages)
      ii. When calculating direct weight all digits will be used in the calculations the final result will be truncated.
      iii. If the bag weight varies more than 25%, more weights may need to be taken; consult the Lead Examiner. Generally 5 additional items will be randomly chosen and their weights will be taken. If these are consistent the average will be based on the 10 readings.
         (a) The analysts and Lead Examiner must consider:
            (i) If the weights obtained will come close to any criteria weight
            (ii) If no criteria weight will be reached
            (iii) If the weight is considerably over a criteria weight
            (iv) If the weight is right at a criteria weight
            (v) Based on the information the Lead Examiner will determine the most appropriate path to take.

When performing weight calculations all digits will be used throughout the calculations. The final value will be truncated as appropriate.

5. Reporting:
   a. In general weights will be reported to three significant figures. Reported weights are truncated not rounded. Exceptions may be made as needed, such as to facilitate the reporting of the uncertainty associated with the weight.
      i. Examples: 1025grams will be reported as 1020 grams
         0.1578grams will be reported as 0.157grams
   b. Uncertainty of Measure: when required (as described in CS 5.1), the uncertainty associated with the measurement will be reported. The analyst must consider several factors when determining if uncertainty will be reported. Uncertainty need only be calculated and reported when the value of a weighed group of items is in a range that brackets a state or federal criteria weight. The range is calculated will be updated annually when uncertainty is reevaluated. It is based on a calculation of U times 100 weighing events from the criteria weight. The bulky balance will be calculated separate from the case balances. For the case balances only the largest U will be used to calculate this range. (See example in CS 5.1)
      i. Is the case a state case or federal case?
      ii. What is the drug being reported?
      iii. Is the drug being reported one of the 5 state or 11 federal substances that have special criteria weights? If it is one of those listed then it must be considered if a criteria weight is approached.
      iv. In general when uncertainty is reported the result obtained will be listed with the uncertainty and confidence interval listed.
         (a) Suggested Example: Item 1A1 = 14.5 grams ( +/- 0.1 g with a 95% C.I.) The uncertainty should be reported to the same level of significance as the sample.
      v. Uncertainty may not be reported for the sub-items of a case, unless the weight of the combined sub-items exceeds a state or federal criteria weight.

G. **CALCULATIONS**:

1. Grams to ounces: divide the number of grams by 28.35
2. Ounces to pounds: divide the number of ounces by 16
3. Net Weight = gross weight – (average bag weight x number of packages)
4. 25% weight difference (for packaging) = ((highest value - lowest value)/highest value) X100

H. **SOURCES OF ERROR:**

1. Failing to tare a balance or weigh boat before adding the sample.
2. Failing to clean the balance before use.
3. Failing to change the weigh boat/paper between samples.
4. Improper calculation of weights; this can range from simple addition problems to errors stemming from the determination of the packing weight to conversion errors.
5. For gross weight determination; failing to subtracting all of the packaging weights that were included in the gross weight.
    a. Example: for bundles of glassine bags the weight of the packaging and the weight of the bundling material may need to be subtracted if it was included in the gross weight.
    b. Not checking the calibration of the balance after it has been moved.

I. **REFERENCES**:

1. State of Connecticut Controlled Substance Laws. State of Connecticut Department of Consumer Protection Controlled Drug Schedules, Violations & Penalties: (http://www.ct.gov/dcp/lib/dcp/pdf/drug_control_pdf/2010_cs_violation.pdf)
2. Federal Controlled Substance Trafficking Penalties http://www.justice.gov/dea/agency/penalties.htm