



## Introduction

This unit describes guidelines to be used when sampling evidence items in the CBI-FS Drug Chemistry Section. This focuses more on the decisions to be made as opposed to the physical manner of sampling (Sampling Procedure) which is taught in the training manual or addressed under CHE 10-20.

The methods described in this unit should be considered general guidelines for daily use. These guidelines apply regardless of the number of defendants listed on the submission form unless the individual samples are identified as coming from a particular defendant. Where the individual items are identified as having come from particular defendants, all items associated with one defendant will be grouped and the guidelines will apply.

### A. General guidelines

1. The analyst's decision on how to best sample a case is dependent on the nature of the item(s) in the case and any specific requests. Sampling will be at the analyst's discretion. There are two basic categories of sampling; using a **Sampling Plan (statistical sampling)** and **Sample selection (non-statistical sampling)**.
2. Colorado's drug laws are governed by the weight of the mixture containing a controlled substance and not the actual quantity of drug contained inside an item with the exception of those pharmaceutical products with specific formulation amounts as listed in schedules III – V.
3. If there is no physical barrier between individual drug samples they need not automatically be subdivided prior to analysis because the legal inference is that they are a mixture as stated in each of the five schedules [CRS 18-18-102; 18-18-203; 18-18-204; 18-18-205; 18-18-206; 18-18-207] under Colorado law and again in [CRS 18-18-403.5; and 18-18-405].<sup>1</sup>, irrespective of the type of drug or dosage form contained inside the container. This type of sampling is performed in accordance with SWGDRUG, ISO/IEC 17025:2017, and ANAB AR 3125.
4. Because of the nature of Colorado statute language concerning mixtures, there is no need to ensure that the items are homogenous prior to sample selection (i.e. removing a portion of crystalline material from a bag). It is therefore unnecessary to use a Sampling Procedure as defined by ISO/IEC 17025:2017 and ANAB AR 3125 because it is not necessary to demonstrate that the results are representative of the whole.
5. The exception to the above is Quantitative analysis. CHE 10-20 describe the appropriate Sampling Procedures to be used to ensure that analytical results are representative of the whole material.
6. Any gaseous or single-layer liquid items, unless otherwise described, are assumed to be homogenous. Solid samples unless uniformly mixed, ground, or described as such are assumed to be non-homogenous.



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### B. Sampling Plan

1. A Hypergeometric sampling plan will be used when there is a desire or need to make an inference to a larger population based upon analysis of a portion.
2. Determine the population (N) based on observations of the evidence and record those observations in the case notes.
3. Weigh the entire population if practicable. If not, document why not (e.g., outside seizure, too large of a seizure, only submitted representative sample(s) of seizure, etc) in the case notes.
4. Use the ENFSI sample calculator (located in Qualtrax) to determine the number of items to be tested.
5. With the ENFSI calculator, determine the minimum number of separated items (n) required for analysis based on the population size (N). Determine the k-value for the specific inference population (k = 0.5, 0.7 or 0.9) and the level of confidence (CL = 95% or 99%) to be used. Make sure this sampling number (n) doesn't exceed the non-statistical sampling number required through direct testing for state weight thresholds. If it does, it may be more efficient to conduct a non-statistical sampling for analysis. Also make sure that an inference of a smaller population (50% versus 70% or 90%) would meet or exceed the state weight threshold.
6. Randomly select the separated item(s) to be sampled and analyzed. Number and weigh separated items according to the item numbering and weighing procedures listed in CHE DOM 10-01 Item Numbering and CHE DOM 10-02 Determining Weights and Volumes. Analyze the selected items individually.
7. It is accepted and expected that the controlled substance(s) identified may be found with different ingredients throughout the items sampled and analyzed, however, the inference is to the presence of one or more controlled substances and not to the exact formulation of the mixture containing the inferred controlled substance(s).
8. Once the initial analysis is completed, reconfirm the confidence limits and statistical values based on both the number analyzed and their individual analytical results. Un-accounted for negative results will reduce the confidence level and will be handled in one of the following three ways:
  - a. The statistical sampling approach will be abandoned and sample selection will be followed. All information about the attempted statistical sampling will be retained in the case notes with an explanation of why it was abandoned.
  - b. The confidence level for the sampling performed will be re-calculated using the ENFSI sampling calculator and that confidence level will be reported (rounded to the nearest whole percent) instead of the initial confidence level.
  - c. The confidence level for the sampling will be re-calculated as above, and the sampled units will be returned to the population. A new sample will be taken, accounting for one or two negatives found during initial sampling. This sample selection must be sufficiently random that there is an equal

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chance to select a previously analyzed unit and a new unit. Confidence levels and proportions for both samplings will be reported.

9. If the analytical results cannot support the inference because there are more than two negative samples then the analyst must abandon the statistical approach and use a non-statistical sampling method.
10. Report the weight of all item(s) tested and their specific test results. Similar analytical conclusions from separated items or sub items can be grouped together for reporting purposes.
11. Also report the weight of the entire population, if possible.
12. Mark all individually tested materials separately and repackage if necessary.
13. Statistical report statements are not analytical test results; they are statistical inferences of what could be expected in the entire population.
14. Initial confidence levels are restricted to 95% or 99% and inference populations are limited to 50%, 70%, or 90% of the population.
15. The confidence level, inference population, population size and sample size will all be recorded in the case notes and appear on the report.

**C. Sample Selection**

1. Sample selection is used when there is no desire or need to make an inference to a larger population based upon analysis of a portion.
2. Select the item(s) to be weighed and or analyzed. Number and weigh them according to the item numbering and weighing procedures listed in the numbering and weighing DOM's (CHE 10-01 and CHE 10-02, respectively), using separated item identifiers or formal LIMS sub-item numbers. Each item separated for analysis is to be weighed and kept separate from other items.
3. If there are specific reasons for sampling in a certain manner then record that reasoning in the case notes. Examples are: statutory weight limits, separating suspected drug material from other non-drug debris in the sample, sampling a spilled portion of sample, rinsing one side of a pipe, partially removing material from container (some also adhered to packaging) and Investigator/DA requests that only specific items be tested.
4. Items containing a physical barrier between suspected drug contents will normally be considered separated items or subitems.
5. A single container item containing multiple units (i.e. tablets, capsules, blotter paper dosages, or any other dosage forms) with no distinct visual differences and no physical barrier between these units need not be automatically subdivided or sub itemized prior to analysis. Record the individual weight(s) of one or more units (e.g., tablets, capsules) removed for testing and the weight of the entire suspected drug material. Report both the weight(s) and number of the materials actually tested and the weight and



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number of the suspected drug material as a whole. This applies regardless of whether the doses are licit or illicit. Analysts may exceed this to reach a threshold weight of analyzed doses, if they choose.

6. Analysts will separate items packaged together with no barrier between them (sub-items) if there is a significant visual difference in appearance between the items (i.e. licit tablets with different physical characteristics, illicit tablets of different color) or if there is other information supporting potentially different content. If there is nothing to indicate items packaged together with no barrier have different content, there may be no need to separate them, but the analyst may do so at their discretion. Marijuana edibles packaged together that are all physically consistent except for color need not be sub-itemed based upon color.
7. The liquid layers in a multi-layered liquid sample are in contact with one another but are not miscible. Multi-layered liquids can be sampled from the top layer downward. Sample the top layer then repeat the procedure for the lower layer being careful to exclude the upper layer liquid. The analyst may choose to sub-item individual layers (i.e. if they can be physically separated and weighed independently) or treat them as separated items and report as individual parts of the whole (i.e. layers that can't be weighed independently).
8. Paraphernalia or residue items may be tested, when necessary.
9. If multiple items are submitted and no controlled substances or analytes of interest are identified in tested items, the analyst will test all other potential items until a controlled substance is identified unless they have approval from their supervisor to not test the additional items. This approval will be documented in the case notes.
10. Analysts may contact the investigating officer or prosecutor to determine which item(s) need to be analyzed. These conversations will be documented in the case file.
11. Analysts may choose to not analyze evidence exceeding the highest weight threshold or plant count.
12. Details of any sample selection performed on multi-unit items will be recorded in the case notes (i.e. "1 tablet selected for analysis") and will appear on the report.
13. For items that are non-homogenous, non-multi-unit populations (i.e. a bag of powder, crystalline material or plant material), a portion will be selected from the non-homogenized item based upon the Analyst's training and experience and the nature of the item. It is not necessary to document this in the case notes.
14. In most cases it is not appropriate to combine different units for analysis. For items with extremely limited analyte, however, it may be necessary. This may be done with a Manager's approval and the results will state that the analysis was performed on a composite of multiple units (i.e. "Analysis of a composite of 2 tablets weighing  $0.45g \pm 0.03g$  identified Lysergic Acid Diethylamide (LSD)...").



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### D. References

1. Colorado Revised Statutes (most current – online edition via Lexis Nexis).
2. United Nations Office on Drugs and Crime, Guidelines on Representative Drug Sampling, ST/NAR/38, United Nations, New York, 2009.
3. Anderson, Practical Statistics for Analytical Chemists, Van Nostrand Reinhold New York, 1987.
4. Kachigan, Statistical Analysis: An interdisciplinary Introduction to Univariate & Multivariate Methods, Radius Press, New York, 1986.
5. Clark, A. B. and C. C Clark. "Sampling of Multi-Unit Drug Exhibits." *Journal of Forensic Sciences* 35.3: 713-9.
6. Frank, R. S., S. W. Hinkley, and C. G. Hoffman. "Representative Sampling of Drug Seizures in Multiple Containers." *Journal of Forensic Sciences* 36.2: 350-7.
7. Ravreby, M. and Tzidony, D. "Statistical Approach to Drug Sampling: A Case Study." *Journal of Forensic Sciences* 37.6: 1541-9.
8. SWGDRUG Recommendations Edition 6.0 (2011-07-07).
9. ENFSI, DWG-SGL-002-rs001\_Hypergeometric\_CalculationBackground\_And\_Validation.pdf.
10. Sampling as listed in ISO/IEC 17025:2017 and ANAB AR 3125.

### E. Additional Factors

#### 1. Sampling Definitions

- a. **Sampling Procedure** – A defined procedure used to collect a sample or samples from the larger whole, to ensure that the value obtained is representative of the whole.
- b. **Sample Selection (Non-statistical sampling)** – Sampling of evidence where there is no statistical inference about the items not tested.
- c. **Sampling Plan (Statistical sampling)** – Sampling of evidence in a manner which results in a portion of the population being sampled, analyzed, and reported with a statistical statement inferring the content of a portion of the unanalyzed items.
- d. **Population Size (N)** – The collection of items which make up one distinct group from which sampling will occur.
- e. **Sample size (n)** – The number of samples tested. For statistical sampling, it is the number of samples required for testing to insure the specific statistical inference statement.
- f. **Confidence Level (CL)** –  $(1-\alpha)$  100%. CBI will use only 95% or 99% confidence levels in the initial calculation, but lower confidence levels may be reported if un-accounted for negative results are obtained.



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- g. **Inference population (K)** – Percentage of the population which is the subject of the inference, in decimal form (i.e. 50% = 0.5; 70% = 0.7; 90% = 0.9).
- h. **( $\alpha$ )** – Threshold index for evaluation of confidence.
- i. **(K)** – Threshold number of positives guaranteed in the population.
- j. **(k)** –  $K/N$  = Ratio of positives guaranteed in the population.