Trace Evidence Sampling and Sample Selection Information

Scope:

To provide a procedure for sample selection and sampling of known and questioned trace evidence samples.

Background Information:

It is expected that the Trace Evidence Unit will use sampling and sample selection in the testing of evidence items. The purpose of sampling is to answer relevant questions about a population by the testing of a portion of the population. In contrast, sample selection answers questions only about the portion tested.

Definitions:

Throughout the Trace Evidence Procedures Manual and the Trace Evidence Training Manuals the following definitions apply:

Sample Selection:

- A practice of selecting a sample(s) of the whole based upon training, experience and competence. There is no assumption of homogeneity of the whole.
- Testing is carried out on the selected sample(s) and the report is clear that the results are based only on the portion(s) tested.

Sampling:

- Taking a part of a substance, material or product to provide for testing of a representative sample of the whole.
- Conclusions are stated about the "whole" based on testing only a portion of the test item.
- There shall be a statistically based or reasonable assumption of homogeneity (or made so by the analyst) of the whole.

Known sample:

- A subset of a larger population or sample originating from a verifiable source, collected as representative of that larger grouping.
- **Questioned or Unknown sample:**

- Materials collected as, or from items of, evidence that have a known location but an unknown origin.

Representative sample:

- A part of the population selected for analysis that represents the variation in the whole.

Random sampling:

- A sample that is selected from a population in a way that ensures that every different possible sample of the desired size has the same chance of being selected.

Target Sampling:

- A sample that is selected to "fit" a certain criteria of the population.

Guidance and Examples:

The analysis of some types of trace evidence samples may involve either **Sample Selection** or **Sampling**. For any given case with multiple samples within the same item and multiple types of evidence within the same case, it is possible that both Sample Selection and Sampling may be used.

Examinations involving fabric damage, footwear and tire tracks, bulbs and filaments, physical matches, and various other Trace examination types do not normally involve Sampling or Sample Selection. If there is a question concerning utilizing Sample Selection versus Sampling, consult with the Trace Evidence Technical Leader.

Sample Selection

Sample Selection is typically performed on questioned items of evidence such as glass, fibers and paint, but may be performed on other types of trace evidence. It is a practice of selecting a sample(s) of the whole based on training, experience, and competence. Examinations are carried out only on the sample(s) selected and the report is clear that the results are based only on the portion(s) tested. There is no assumption of homogeneity of the whole.

Note: The following are examples and guidelines for the analyst. There may be additional more extensive sampling guidelines within the Trace Evidence subdiscipline procedures and training manuals.

Examples of report wording have been given for associations. A number of interpretations may be reached after evaluating and comparing evidence. Also see the various sub-discipline specific procedure manuals for Trace.

Glass: The analyst should analyze a representative sample of glass that displays the range of variation seen within the known sample. When numerous pieces of glass are present in the questioned sample, the scientist will evaluate the glass pieces on a case by case basis and should attempt to analyze at minimum a representative sample of glass. This is based upon the knowledge, skills, and training of the examiner and on any limitation(s) of the sample (such as: size, contamination, additional analysis by other sections, etc.)

- Questioned Glass: Selection of a sufficient number of questioned glass pieces for analysis takes place during the initial processing and should be chosen based on color, size, surface features, thickness and fluorescence if applicable.

- Report Wording Example: "The tested (or #) of the fragments recovered from Item XX corresponded in color, thickness, elemental composition, etc. to the known glass in Item YY..."

Paint/Polymer:

- Questioned Paint: When multiple paint samples are submitted within one questioned Item the analyst, at their discretion, can select a representative unknown sample based on size, shape, color, condition, weathering characteristics and layer structure for comparison, Multiple unknown samples can be chosen for comparisons if the color, condition, weathering characteristics and layer structure of the known cannot be represented in a single unknown.

- Report Wording Example: "The tested questioned paint chip(s) from Item XX corresponded to the known paint Item YY with respect to color, layer structure, chemical solubility tests, etc...."

Fibers:

- Questioned Fibers: When numerous fibers are present in the unknown sample, the scientist will evaluate the fibers on a case by case basis and should attempt to examine a representative sample of fibers. This should be based on color, size, shape, twist and crimp, etc.

- Report Wording Example: "The # (number) questioned fibers from Item XX corresponded with respect to color, type, microscopical appearance, etc. to the known fibers from the Item YY shirt..."

Pressure Sensitive Tape:

- Questioned Tape: The analyst will determine the adequate size of the tape sample for comparison based on knowledge, skills, training, and factoring in additional analyses requested (such as latent print processing). When multiple pieces of tape are submitted as one item, the scientist chooses a representative sample from the questioned pieces based on macroscopic and stereomicroscopic observations, color, thickness, width, surface features and reinforcement construction.

- Report Wording Example: "The # (number) Item XX questioned duct tape pieces from the victim's wrist and Item YY tape roll corresponded in color, surface texture, chemical composition.etc..."

Explosives & General Unknowns:

- Questioned Samples: The analyst will use a variety of techniques to qualitatively determine the presence of a variety of chemical components in an explosive or unknown material.

Sampling

Sampling is typically performed on known items of evidence such as glass, paint, fibers, explosives, general unknowns, fire debris and tape. Two key factors with sampling include (1) the report will state conclusions about "the whole" based on testing only a portion and (2) there must be reasonable assumption of homogeneity of the whole.

Known Glass: When an entire known sample such as an intact piece of broken glass is submitted, any sample taken from the glass pane represents the entire known. When multiple pieces of glass are submitted as the known; a representative sample is chosen based on color, size, surface features, thickness and fluorescence if applicable.

Known Item/Liquid/Powder: When an entire known solid homogeneous item or liquid is submitted, any sample taken from the item represents the entire known. Examinations (via stereoscopic, microscopic examinations for example) of submitted known powders should be performed to determine the homogeniety of the powder.

Known Paint/Polymer: A representative sample of known paint or polymer that displays the range of variation seen within the sample is required for analysis. This is based upon the knowledge, skills, and training of the examiner and on any limitation(s) of the sample (such as: size, contamination, additional analysis by other experts, etc.)

- Known Paint: When an entire known sample such as a paint chip from a vehicle is submitted, any sample including all layers taken from the paint chip represents the entire chip. When multiple pieces of paint are submitted as the known, a representative sample is chosen based on size, shape, color, condition, weathering characteristics and layer structure. Knowledge of the manufacturing process for the types of paint encountered in casework (automotive, architectural, etc.) aids in choosing a representative known sample.

Known Fibers: The analyst should examine a representative sample of fibers that display the range of variation seen within the known sample. This is based upon the knowledge, skills, and training of the examiner and on any limitation(s) of the sample (such as: size, contamination, additional analysis by other experts, etc.)

- Known Fibers: When an entire known sample is submitted and is either a textile and/or a sample of fibers selected by crime scene personnel/investigator the scientist can assume homogeneity. Knowledge of the manufacturing process for the types of fiber evidence encountered in casework, similar color, garment construction, upholstery, cordage/ropes etc. aids in choosing an appropriate representative known sample.

Known Pressure Sensitive Tape: The analyst should analyze a representative sample of tape that displays the range of variation seen within the known sample. This is based upon the knowledge, skills,

and training of the examiner and any limitation(s) of the sample (such as size, contamination, additional analysis by other sections, etc.)

- Known Tape: When an entire known sample such as a roll of tape is submitted it can be assumed that any sample taken from the tape roll represents the entire known.

General Unknowns:

- Known Samples: Known reference compounds are often submitted or are maintained in the Trace Unit. Sampling of these can be considered a representative sample of the known.

- Report Wording Example: "The questioned white powdery substance submitted as Item XX is consistent with cornstarch."

Further Information:

Selection, recovery, prioritization and sampling of materials from submitted evidence are an important part of the analysis of trace evidence. The above examples are not mutually exclusive to the types of evidence discussed under each type of sampling. If the analyst is examining an evidentiary item not listed above, they should apply the above guidelines for sample selection and/or sampling.

There may be situations where a representative sample of the known and/or unknown precludes sampling over sample selection and vice versa. In this circumstance, information about those decisions by the analyst should be in the case record notes. In all instances the necessity for further testing on additional samples is left to the judgment of the analyst.

References:

- Scientific Working Group for Materials Analysis (SWGMAT) Fiber Documents

- DeVore, Jay L and Peck, Roxy. Statistics: The Exploration and Analysis of Data. Third Edition, Wadsworth Publishing