# Training Outline for the Examination of Tape

**1.0 Purpose** – This document provides an outline for training in the examination of tape evidence, including the requisite competency testing.

**2.0 Scope** – This training outline shall be followed by all trainees in tape examinations, regardless of experience level.

## 3.0 Module 1 – Introduction to Tapes and Adhesives

**3.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge of:

**3.1.1** The history and use of tapes and adhesives.

**3.1.2** The manufacturing processes for tapes and adhesives.

**3.1.3** Chemical formulations and compositions of various tapes and adhesives.

### 3.2 Reading Assignments

**3.2.1** Shurtape, "Duct Tape Fundamentals." January 10, 2006.

**3.2.2** SWGMAT. "Guideline for the Forensic Examination of Pressure-Sensitive Tapes." *Forensic Science Communications* 10.4 (2008).

**3.2.3** Benson, J.D. "Forensic Examination of Duct Tape." *Proceedings of the International Symposium on the Analysis and Identification of Polymers* (July- August 1984): 145-146.

**3.2.4** Blackledge, R.D., ed. *Forensic Analysis on the Cutting Edge*. John Wiley & sons, 2007. Chapter 12.

**3.2.5** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, June 2005 (tape overview section).

**3.2.6** Snodgrass, H. "Duct Tape Analysis as Trace Evidence." *Proceedings of the International Symposium on the Forensic Aspects of Trace Evidence* (June 1991): 69-73.

### 3.3 Exercises

**3.3.1** Read literature pertaining to the history, manufacturing, and formulations of pressure sensitive tapes and adhesives.

### 3.4 Evaluation

**3.4.1** Successfully complete a written examination covering the reading assignments.

## 4.0 Module 2 – Stereomicroscopic Evaluation of Tapes and Adhesives

**4.1** **Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**4.1.1** Unravel tape that has been stuck together.

**4.1.2** Identify tape classes.

**4.1.3** Discern unique features and/or surface characteristics.

**4.1.4** Recognize and recover other trace evidence from tape.

**4.1.5** Break down tape into its major components.

**4.1.6** Make cross-sections of tape backings.

**4.1.7** Describe the weave and knit patterns of duct tape scrim fabric.

**4.1.8** Prepare scrim for microscopic examination.

**4.1.9** Describe how a physical match may be made.

**4.2** **Reading Assignments**

**4.2.1** SWGMAT. "Guideline for Assessing Physical Characteristics in Forensic Tape Examinations." online (December 14, 2010): http://www.swgmat.org/SWGMAT%20Assessing%20Physical%20Characteristics.pdf

**4.2.2** Bradley, M.J., R.L. Keagy, P.C. Lowe, M.P. Rickenbach, D.M. Wright and M.A. LeBeau. "A Validation Study for Duct Tape End Matches." *Journal of Forensic Sciences* 51.3 (2006): 504-508.

**4.2.3** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, June 2005 (fabric section).

**4.2.4** Hobbs, A.L., et al. "A New Approach for the Analysis of Duct Tape Backings." *Forensic Science Communications* 9.1 (2007).

**4.2.5** Keto, R.O. "Forensic Characterization of Black Polyvinylchloride Electrical Tape." *Crime Laboratory Digest* 11.4 (1984): 71-74.

**4.2.6** Smith, J. "The Forensic Value of Duct Tape Comparisons." *Midwestern Association of Forensic Scientists Newsletter* 27.1 (1998): 28-33.

**4.2.7** Teetsov, A.S. and M.L. Stellmack. "Hand-Sectioning and Identification of Pressure-Sensitive Tapes." *Modern Microscopy Journal* (June 30, 2004).

**4.3** **Exercises**

**4.3.1** Read literature pertaining to this module.

**4.3.2** The trainee shall practice various methods (i.e. methanol, chloroform, heptane, hexane, toluene, inverted compressed air canister, liquid nitrogen, heat gun, freezer) to separate tape that has been stuck together.

**4.3.3** The trainee shall learn to identify different classes of tape (i.e. duct tape, electrical tape, packaging tape, masking tape, office tape) and shall become familiar with manipulation under the stereomicroscope. The trainee shall use these tapes to record physical observations and measurements.

**4.3.4** The trainer shall discuss removal/recovery of trace evidence from tape or adhesive.

**4.3.5** The trainee shall practice removing adhesive from tape.

**4.3.6** The trainee shall practice making cross-sections of several tape backings.

**4.3.7** The trainee shall examine the scrim fabrics of a minimum of 10 duct tapes and document the weave/knit pattern.

**4.3.8** The trainee shall remove scrim fibers and prepare them for further analysis. If the trainee is a fiber examiner, he/she shall mount the fibers and perform a full fiber analysis on the scrim fibers.

**4.3.9** The trainee shall complete section 4.0 of the Trace Unit Training Outline for Physical Match Examinations using tape samples.

### 4.4 Evaluation

**4.4.1** The trainer and the trainee shall review and discuss the pertinent points of the required reading and exercises.

## 5.0 Module 3 – Polarized Light Microscopy

**5.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**5.1.1** Explain the theory of polarized light microscopy.

**5.1.2** Apply polarized light microscopy techniques to tape and adhesive samples.

**5.1.3** Recognize unique features and/or characteristics in tapes or adhesives.

### 5.2 Reading Assignments

**5.2.1** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, May 2008 (PLM section).

**5.2.2** Maynard, P., et al. “Adhesive Tape Analysis: Establishing the Evidential Value of Specific Techniques.” *Journal of Forensic Sciences* 46.2 (2001): 280-287.

**5.2.3** Blackledge, R.D. ed. *Forensic analysis on the Cutting Edge*. John Wiley & sons, 2007. Chapter 12.

**5.2.4** Rappe, Rodney G. "Microscopical Examination of Polymer Films." *Microscope* 40 (1992): 93-101.

**5.2.5** SWGMAT. "Guideline for Using Light Microscopy in forensic Examination of Tape Components." online (December 14, 2010): http://www.swgmat.org/Standard%20Guide%20for%20Using%20Scanning%20Electron.pdf.

### 5.3 Exercises

**5.3.1** Read literature pertaining to this module.

**5.3.2** The trainee shall successfully complete the Polarized Light Microscopy module in the Fiber Training Outline.

**5.3.3** The trainee shall examine samples of packaging or office tape. Record observations regarding the tape's overall physical characteristics and how the tape appears under both transmitted light and crossed polars.

### 5.4 Evaluation

**5.4.1** The trainer and the trainee shall review and discuss the pertinent points of the required reading and exercises.

## 6.0 Module 4 – FT-IR

**6.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**6.1.1** Explain the theory of FT-IR analysis.

**6.1.2** Prepare tape and adhesive samples for FT-IR analysis.

**6.1.3** Identify common tape and adhesive components by their infrared spectra.

**6.1.4** Obtain consistent spectral data from different samples from the same source.

### 6.2 Reading Assignments

**6.2.1** Blackledge, R.D., ed. *Forensic analysis on the Cutting Edge*. John Wiley & sons, 2007. Chapter 12.

**6.2.2** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, May 2008 (FT-IR section).

**6.2.3** Goodpaster, J.V., et al. "Identification and Comparison of Electrical Tapes Using Instrumental and Statistical Techniques: II. Organic Composition of the Tape Backing and Adhesive." *Journal of Forensic Sciences* 54.2 (2009): 328-338.

**6.2.4** Maynard, P., et al. "Adhesive Tape Analysis: Establishing the Evidential Value of Specific Techniques." *Journal of Forensic Sciences* 46.2 (2001): 280-287.

**6.2.5** Mehltretter, A.H., M.J. Bradley and D.M. Wright. "Analysis and Discrimination of Electrical Tapes: Part I. Adhesives." *Journal of Forensic Sciences* published online September 30, 2010.

**6.2.6** Merrill, R.A. and E.G. Bartick. "Analysis of Pressure Sensitive Adhesive Tape: I. Evaluation of Infrared ATR Accessory Advances." *Journal of Forensic Sciences* 45.1 (2000): 93-98.

**6.2.7** Sakayanagi, M., et al. "Identification of Pressure- Sensitive Adhesive Polypropylene Tape." *Journal of Forensic Sciences* 48.1 (2003): 68-76.

### 6.3 Exercises

**6.3.1** Read literature pertaining to this module.

**6.3.2** The trainer shall demonstrate different IR preparation techniques.

**6.3.3** The trainee shall take IR spectra of the backings of a minimum of 10 tape samples.

**6.3.4** The trainee shall take IR spectra of the adhesives of a minimum of 10 tape samples.

**6.3.5** Using a single tape source, acquire 5 IR spectra of that are consistent with each other.

**6.3.6** The trainee shall identify the major components present in each spectrum from the previous exercise.

### 6.4 Evaluation

**6.4.1** The trainee shall be given 3 sets of tape samples to determine correctly if they could have shared a common origin, using IR only.

**6.4.2** The trainee shall correctly identify the major components present in 5 IR spectra provided by the trainer.

## 7.0 Module 5 – SEM-EDS

**7.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**7.1.1** Explain the basic theory of SEM-EDS analysis.

**7.1.2** Prepare samples for SEM-EDS analysis.

**7.1.3** Interpret the resulting spectra.

### 7.2 Reading Assignments

**7.2.1** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, May 2008 (SEM-EDS section).

**7.2.2** Goodpaster, J.V., et al. "Identification and Comparison of Electrical Tapes using Instrumental and Statistical Techniques: I. Microscopic Surface Texture and Elemental Composition." *Journal of Forensic Sciences* 52.3 (2007).

**7.2.3** Blackledge, R.D., ed. *Forensic analysis on the Cutting Edge*. John Wiley & sons, 2007. Chapter 12.

### 7.3 Exercises

**7.3.1** Read literature pertaining to this module.

**7.3.2** The trainer shall demonstrate how to prepare samples for SEM-EDS analysis.

**7.3.3** The trainee shall prepare 3 backing samples for SEM-EDS analysis, including a cross-section of the tape backing.

**7.3.4** The trainee shall prepare 3 adhesive samples for SEM-EDS analysis.

**7.3.5** The trainee shall observe an SEM-EDS operator analyze a minimum of one tape sample and discuss the process of running samples and interpretation of the resulting spectra.

### 7.4 Evaluation

**7.4.1** The trainer and the trainee shall review and discuss the pertinent points of the required reading and exercises.

## 8.0 Module 6 – Pyrolysis-GC-MS

**8.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**8.1.1** Explain the theory of pyrolysis-GC-MS analysis.

**8.1.2** Prepare samples for pyrolysis-GC-MS analysis.

**8.1.3** Interpret the resulting chromatograms.

### 8.2 Reading Assignments

**8.2.1** Forensic Analysis of Pressure Sensitive Tapes Training Course Materials, FBI, May 2008 (Py-GC-MS section).

**8.2.2** Blackledge, R.D., ed. *Forensic Analysis on the Cutting Edge*. John Wiley & sons, 2007. Chapter 12.

**8.2.3** Maynard, P., et al. "Adhesive Tape Analysis: Establishing the Evidential Value of Specific Techniques." *Journal of Forensic Sciences* 46.2 (2001): 280-287.

### 8.3 Exercises

**8.3.1** Read literature pertaining to this module.

**8.3.2** The trainer shall demonstrate how to prepare samples for pyrolysis GC-MS analysis.

**8.3.3** The trainee shall prepare 5 samples of adhesive for pyrolysis GC-MS analysis.

**8.3.4** The trainee shall observe a pyrolysis GC-MS operator analyze a minimum of one tape sample and discuss the process of running samples and interpretation of the resulting chromatograms.

### 8.4 Evaluation

**8.4.1** The trainer and the trainee shall review and discuss the pertinent points of the required reading and exercises.

## 9.0 Module 7 – Casework, Final Evaluation and Preparation for Court

**9.1 Objectives:** Through completion of this module, the trainee shall have developed and demonstrated the theoretical knowledge and/or practical skills to:

**9.1.1** Describe evidence handling procedures, evidence collection, evidence packaging, and chain of custody.

**9.1.2** Recognize and preserve other items of potential evidentiary value.

**9.1.3** Effectively document evidence condition, analytical methods used, and reasons for conclusions in the case file in a method understandable to fellow analysts.

**9.1.4** Write clear and concise Laboratory Reports consistent with Laboratory and Section guidelines.

**9.1.5** Demonstrate courtroom procedures.

**9.1.6** Effectively present the results of a tape examination in court.

**9.1.7** Describe the legal and ethical obligations of an expert witness.

**9.1.8** Describe the admissibility standards set by *Daubert* and *Frye*.

### 9.2 Reading Assignments

**9.2.1** CVs or Statements of Qualifications of other Forensic Scientists.

**9.2.2** *Daubert v. Merrill Dow Pharmaceuticals*, 509 U.S. 579 (1993).

**9.2.3** *Frye v. United States*, 293 F. 1013 (DC Cir. 1923).

**9.2.4** Feder, H.A. and M.M. Houck. *Succeeding as an Expert Witness, 4th ed*. Boca Raton: CRC Press, 2008.

**9.2.5** Kogan, J.D. "On Being a Good Expert Witness in a Criminal Case." *Journal of Forensic Sciences* 23.1(1978): 190-200.

**9.2.6** Philipps, K.A. "The Nuts and Bolts of Testifying as a Forensic Scientist." *Journal of Forensic Sciences* 22.2 (1977): 457-463.

**9.2.7** Ron Smith and Associates, Inc. "Courtroom Testimony Techniques: Success Instead of Survival." Collinsville, Mississippi.

**9.2.8** Tanton, R.L. "Jury Preconceptions and Their Effect on Expert Scientific Testimony." *Journal of Forensic Sciences* 24.3 (1979): 681-691.

## 9.3 Exercises

**9.3.1** Read literature pertaining to this module.

**9.3.2** Perform casework with a qualified Forensic Scientist. The following shall be discussed and practiced with the trainee:

**9.3.2.1** Proper procedures for taking notes and marking evidence.

**9.3.2.2** Proper procedures for handling and analyzing known standards and unknown samples.

**9.3.2.3** Determination of which examination(s) apply to each individual case.

**9.3.2.4** The possible conclusions from a tape comparison.

**9.3.3** Prepare or update a CV or Statement of Qualifications reflective of experience in tape examination.

**9.3.4** Prepare a series of qualifying questions and answers to those questions for use in a voir dire.

**9.3.5** Observe pretrial conferences and courtroom testimony of qualified Forensic Scientist, if possible.

## 9.4 Evaluation

**9.4.1** The trainee shall be given two (2) mock cases to analyze and prepare reports, as if they were actual cases.

**9.4.2** Using one of the mock cases, successfully complete a moot court or roundtable discussion.

**9.4.3** Successfully complete a final competency test covering all training materials.

## 10.0 Records

- Training file
- Training checklist

**11.0 Attachments** – N/A

| **Revision History** | | |
|---|---|---|
| Effective Date | Version Number | Reason |
| 09/17/2012 | 1 | Original ISO Document |
| 10/18/2013 | 2 | Added issuing authority to header |
| 08/29/2014 | 3 | Updated header to Physical Evidence Section – Trace Unit, issuing authority to Physical Evidence Section Forensic Scientist Manager |
| 03/20/2015 | 4 | Edited 4.3.9 to refer to correct section of Physical Match training procedure |
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