Training Outline for the Examination of Explosives Evidence

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

2.0 Scope – This training outline shall be followed by all trainees in the examination of explosives evidence, regardless of experience level.

3.0 Training Procedure

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

3.1.1 The history, manufacturing, and blast effects of explosives.

3.1.2 The classification of explosives into one of two categories, low or high.

3.1.3 The composition of the common low explosives including but not limited to pyrotechnics and photo flash powders.

3.1.4 The construction and firing trains of improvised explosive devices.

3.1.5 Evidence handling, evidence collection, evidence packaging, and chain of custody for explosives evidence.

3.1.6 Recognition and preservation of other items of potential evidentiary value.

3.1.7 The proper procedures/techniques for photographing different devices and their components, taking notes, and marking evidence.

3.1.8 Performance of a complete explosives analysis from receiving the evidence to writing the laboratory report.

3.1.9 Documentation of evidence condition, analytical methods used, and reasons for conclusions in the case file in a method understandable to fellow forensic scientists.

3.1.10 Preparation of a clear, accurate, and concise laboratory report consistent with laboratory and section guidelines.

3.1.11 Presentation of your findings and conclusions accurately as an expert witness in a courtroom setting.

3.1.12 Courtroom procedures.

3.1.13 The legal and ethical obligations of an expert witness.

3.1.14 The admissibility standards set by *Daubert* and *Frye*.

3.2 Readings Assignments

3.2.1 State Crime Laboratory Evidence Guide.

3.2.2 TWGFEX Laboratory Explosion Group Standards & Protocols Committee, Recommended Guidelines for Forensic Identification of Intact Explosives.

3.2.3 TWGFEX Laboratory Explosion Group Standards & Protocols Committee, Recommended Guidelines for Forensic Identification of Post-Blast Explosive Residues.

3.2.4 Beveridge, A. *Forensic Investigation of Explosions*. Bristol, PA: Taylor & Francis, 1998.

3.2.5 Crippin, J.B. *Explosives and Chemical Weapons Identification.* New York: CRC Press Taylor & Francis. 2006.

3.2.6 Brucker, E.W. "Blasting Cap Recognition and Identification Manual." Gaithersburg, Maryland: International Association of Chiefs of Police, Inc. 1973.

3.2.7 Crockett, T.S. and C.R. Newhouser. "Recognition of Explosive and Incendiary Devices. Part I. Hand and Rifle Grenades." Gaithersburg, Maryland: International Association of Chielfs of Police, Inc.

3.2.8 Crockett, T.S. and C.R. Newhouser. "Recognition of Explosive and Incendiary Devices. Part II. Land Mines, Artillery, Mortars, and Rocket Projectiles." Gaithersburg, Maryland: International Association of Chiefs of Police, Inc.

3.2.9 Davis, T.L. "The Chemistry of Powder and Explosives." California: Angriff Press, (Reprint of 1943 edition).

3.2.10 Fedoroff, B.T. and O.E. Sheffield. "Encyclopedia of Explosives and Related Items." PATR 2700, Picatinny Arsenal, Dover, New Jersey, Volumes 1-10.

3.2.11 Feigl, F. *Spot Tests in Inorganic Analysis*. New York: Elsevier Publishing Company. 1972.

3.2.12 Feigl, F. *Spot Tests in Organic Analysis*. New York: Elsevier Publishing Company. 1966.

3.2.13 Jungries, E. *Spot Test Analysis - Clinical, Environmental, Forensic and Geochemical Applications.* New York: John Wiley and Sons, Inc. 1985. Chapter 4.3: Spot Tests for Explosives and Explosive Residues.

3.2.14 Saferstein, R. ed. *Forensic Science Handbook.* 1st ed., Englewood Cliffs: Prentice Hall Inc., 1982, pp. 239-266.

3.2.15 Swearengen, T.F. "Tear Gas Munitions." Springfield, Illinois: Charles C. Thomas, 1966.

3.2.16 Yinon, J. and S. Zitrin. "The Analysis of Explosives." New York: Pergamon Press. 1981.

3.2.17 General Information Bulletin 74-8, National Bomb Data Center, 1974.

3.2.18 Lange. *Handbook of Chemistry*. 10th ed., McGraw Hill, 1971.

3.2.19 CVs or Statements of Qualifications of other Forensic Scientists.

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

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

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

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

3.2.24 Published Journal Articles

3.2.24.1 Meyer, R.E. "A Systematic Approach to the Forensic Examination of Flash Powders." *Journal of Forensic Sciences* 23.1 (1978): 66-73.

3.2.24.2 Washington, W.D. and C.R. Midkiff. "Forensic Applications of diamond Cell-Infrared Spectroscopy. 1: Identification of Blasting Cap Leg Wire Manufacturers." *Journal of Forensic Sciences* 21.4 (1976): 862-867.

3.2.24.3 Washington, W.D., C.R. Midkiff and K.B. Snow. "Dynamite Contamination of Blasting Cap Leg Wire Insulation." *Journal of Forensic Sciences* 22.2 (1977): 329-331.

3.2.24.4 Kopec, R.J., W.D. Washington and C.R. Midkiff. "Forensic Applications of Sapphire Cell-Infrared Spectroscopy: Companion to the Diamond Cell in Explosive and Leg Wire Identification." *Journal of Forensic Sciences* 23.1(1978): 57-65.

3.2.24.5 Hardy, D.R. and J.J. Chera. "Differentiation Between Single-Base and Double-Base Gunpowders." *Journal of Forensic Sciences* 24.3 (1979): 618-622.

3.2.24.6 Hoffman, C.M. and E.B. Byall. "Identification of Explosive Residues in Bomb Scene Investigations." *Journal of Forensic Sciences* 19.1 (1974): 54-63.

3.2.24.7 Parker, R.G., et al. "Analysis of Explosives and Explosive Residues. Part 1: Chemical Tests." *Journal of Forensic Sciences* 20.1 (1975): 133-140.

3.2.24.8 Parker, R.G., J.M. McOwen and J.A. Cherolis. "Analysis of Explosives and Explosive Residues. Part 2: Thin-Layer Chromatography." *Journal of Forensic Sciences* 20.2 (1975): 254-256.

3.2.24.9 Parker, R.G. "Analysis of Explosives and Explosive Residues. Part 3: Monomethylamine Nitrate." *Journal of Forensic Sciences* 20.2 (1975): 257-260.

3.2.24.10 Chrostowski, J.E., R.N. Holmes and B.W. Rehn. "The Collection and Determination of Ethylene Glycol Dinitrate, Nitorglycerine, and Trinitrotoluene Explosive Vapors." *Journal of Forensic Sciences* 21.3 (1976): 611-615.

3.2.24.11 Sreenivasan, V.R. and R.A. Boese. "Identification of Lachrymators." *Journal of Forensic Sciences* 15.3 (1970): 433-442.

3.2.24.12 DeHann, J.D. "Quantitative Differential Thermal Analysis of Nitrocellulose Propellants." *Journal of Forensic Sciences* 20.2 (1975): 243-253.

3.2.24.13 Beveridge, A.D., et al. "Systematic Analysis of Explosive Residues." *Journal of Forensic Sciences* 20.3 (1975): 431-454.

3.2.24.14 Zack, P.J. and J.E. House. "Propellant Identification by Particle Size Measurement." *Journal of Forensic Sciences* 23.1 (1978): 74-77.

3.2.24.15 Peimer, R.E., W.D. Washington and K.B. Snow. "On the Examination of the Military Explosive, C-4." *Journal of Forensic Sciences* 25.2 (1980): 398-400.

3.2.24.16 Yinon, J. and S. Zitrin. "Processing and Interpreting Mass Spectral Data in Forensic Identification of Drugs and Explosives." *Journal of Forensic Sciences* 22.4 (1977): 742-747.

3.2.24.17 Yinon, Jehuda. "Analysis of Explosives by Negative Ion Chemical Ionization Mass Spectrometry." *Journal of Forensic Sciences* 25.2 (1980): 401-407.

3.2.24.18 Kantrowitz, S.B. "Expert Testimony and Scientific Evidence in Arson-Related Cases." *Journal of Forensic Sciences* 26.1 (1981): 142-152.

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

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

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

3.3 Exercises

3.3.1 Read required literature and demonstrate an understanding of the content.

3.3.2 Perform casework with qualified Forensic Scientists. The trainee shall show proficiency in:

3.3.2.1 Proper procedures for taking notes and marking evidence.

3.3.2.2 Proper procedures/techniques for photographing different devices and their components

3.3.2.3 Proper procedures for handling and analyzing standards and unknown samples.

3.3.2.4 Proper procedures for collecting particles from evidence.

3.3.2.5 Proper packaging for evidence.

3.3.2.6 Conclusions and report writing.

3.3.3 Demonstrate proficiency in the operation and use of equipment, instruments, and techniques to examine explosives evidence including the following:

3.3.3.1 Demonstrate the ability to use a stereomicroscope properly and examine several intact known explosives.

3.3.3.2 Examine explosive debris and demonstrate the ability to screen debris to find intact particles and explosive residues.

3.3.3.3 Demonstrate an understanding of the presumptive chemical tests used in explosives analysis and examine several known explosives, both intact and post-combustion, using the presumptive chemical tests.

3.3.3.4 Demonstrate an understanding of polarized light microscopy techniques used to identify explosives and examine several known explosives, both intact and post-combustion, using polarized light microscopy.

3.3.3.5 Demonstrate an understanding of the common extraction procedures used in explosives analysis and perform extractions on several known explosives, both intact and post-combustion, using the extraction procedures.

3.3.3.6 Demonstrate an understanding of the theory and application of Fourier Transform Infrared Spectroscopy (FT-IR) to explosives analysis and examine several known explosives, both intact and post-combustion, using FT-IR.

3.3.3.7 Demonstrate an understanding of the theory and application of Scanning Electron Microscopy (SEM) to explosives analysis and examine the SEM spectra of several known explosives.

3.3.3.8 Demonstrate an understanding of the theory and application of Gas Chromatography-Mass Spectrometry (GC-MS) to explosives analysis and examine several known explosives, both intact and post-combustion, using GC-MS.

3.3.3.9 Demonstrate an understanding of the theory and application of X-Ray Diffraction (XRD) to explosives analysis and examine the XRD data from several known explosives, both intact and post-combustion.

3.3.3.10 Demonstrate an understanding of the theory and application of Capillary Electrophoresis (CE) to explosives analysis and examine the CE data from several known explosives, both intact and post-combustion.

3.3.3.11 Summarize the similarities, differences, and identified components of several known explosives using all available instrumental data.

3.3.3.12 Prepare or update a CV or Statement of Qualifications reflective of experience in explosives examination.

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

3.3.3.14 Observe pretrial conferences and courtroom testimony of qualified Forensic Scientist(s), if possible.

4.3 Evaluation

4.3.1 Successfully complete a comprehensive written examination to evaluate overall proficiency in explosives analysis.

4.3.2 Correctly identify the composition of a set of unknown explosives which will include a minimum of six explosives or explosives mixtures.

4.3.3 Evaluate and interpret the results of five cases, given the case notes from each case. Prepare a report for each of the five cases with accurate conclusions.

4.3.4 Correctly classify the evidence from five different explosions as either high or low order explosions.

4.3.5 Correctly determine if three mock devices containing an intact firing train would detonate if the firing train were initiated.

4.3.6 Given the remains of four exploded devices, correctly determine what type of device was used in the explosion.

4.3.6.1 Generate an entire Case Record and draft a report for each device.

4.3.6.2 Defend one of these reports in a moot court situation or roundtable discussion.

4.0 Records

- Training file
- Training checklist

4.0 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; 3.2.8 - corrected spelling of city
08/29/2014	3	Updated header to Physical Evidence Section – Trace Unit, issuing authority to Physical Evidence Section Forensic Scientist Manager. Updated all references in procedure from Trace Evidence Section to Trace Unit.