Abbreviations

1 Introduction

The following is a list of commonly used abbreviations in Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace) case notes. It is not intended to be an all-inclusive list. If an abbreviation is used that is not listed, and is specific to the laboratory, it will be defined in the case notes. Bigraph and trigraph country codes may be used to abbreviate countries. The lists for these codes are maintained on BUNET.

2 Scope

This document applies to individuals who perform examinations in the categories of testing of hairs, fibers and textiles, geologically-derived materials, glass, and anthropology.

3 Abbreviations

~, ≈, app, approx, aprx	approximate, approximately, approximation
∴	because/therefore
β	birefringence
≠	does not equal, not consistent with, dissimilar
↑	evolves gas, high amount (number of arrows indicates strength of reaction, or amount, respectively)
↓	low amount/no gas evolution/all other hairs measured are shorter than this (hair)
(-)	negative
(?)	indicates uncertainty
//	parallel
⊥	perpendicular
(+)	positive
=	consistent with, to the limit of the specific examinations performed
→	to, into, transferred to, through
↕	warp direction
↔	weft direction
∅	absent
<○>	“fish eyes”
∡	angle
Δ	triangle, triangular
abs	absent

ack	acknowledge
Afr	African
AH	animal hair
alt	alternates
am	antemortem
amt	amount
ANa	Asian or Native American
ana	anagen
ant	anterior
a-p	anterior-posterior/posterior-anterior
art trt, at, AT	artificially treated
assoc	associated
avg	average
Batt(s)	battery (ies)
bc	barcode
BH	Body hair
bkn	broken
bi, bilob	bilobal
bl	blue
blk	black
bpb	brown paper bag
br, brn	brown
brt	bright
bw, b/w, btw	between
C, cerv	Cervical
C(#)	cervical vertebra number #
calc	calcaneus
cat	catagen
CB	circuit board
cc, c/c	clear, colorless
C C M	cuticle / cortex / medulla (in description of known hair samples)
CF, cf	cortical fusi
char	characteristic(s)
chem	chemical
chg	change
CI	confidence interval
circum	circumference
co	cortex
comp	composition/components
compM	comparison microscopy
cont	continuous
conv	conversation
cort	cortical

CPI	crowns per inch
Cran	cranium/cranial
cs	cross section
CTF	carpet-type fiber
cu	cuticle
d, D, Dia, diam	diameter
del, delust, dl	delustered
Decid	deciduous
decomp	decomposing, decomposed/decomposition
delt	deltoid
dens	density
dent	dental
detc'd	detected
discont	discontinuous
dist, distr	distribution
dist	distal
DI H_2O	deionized water
dk	dark
dtf	denim type fiber
ecto,	ectocran ectocranial
endo, endocran	endocranial
env	envelope
epicond,	epicondyle epicondylar
epiph	ephiphysis/epipyseal
EtOH	ethanol
Eur, Euro	European
evid	evidence
exp / expl	explosive
ext	external
f(s)	fiber(s)
f/	fraction thereof or something is a function of something
fac	facial
fem	femur/femoral
fib	fibula
FH	facial hair
FLM	fluorescence light microscopy
for	foramen foramina
for mag	foramen magnum
fr, FR	forcibly removed
frac, fx	fracture
frag, frg	fragment
FSL	fiber slide

FTIR	Fourier Transform Infrared Spectroscopy
g, grn	green
gls	glass
gran	granules
GRIM	Glass Refractive Index Measuring system
h(s)	hair(s)
H&F, h/f, hf	hairs and fibers
HCl	hydrochloric acid
HH	head hair
Hisp	Hispanic
horiz	horizontal
HSL	hair slide
ht	height
hum	humerus
hv, hvy	heavy
I	Item
ICP	Inductively-coupled plasma
ID	identification
inf	inferior
innom	innominate
int	interior (anthro)
IP	In-processing
IPC	In-Processing Chain
IR	infra-red
Irr	irregular
isch	ischium/ischial (anthro)
Kn, KN	known
KNSL	known slide
L	left
l(#)	lumbar vertebra number #
LA	laser ablation
lab	labial
lat	lateral
Len, lgth	length
lg	large
lgth, Len	Length
LH(s)	Limb hair(s)
ling	lingual
lt	light
lust, l	lustrous
l vert	lumbar vertebra

LVFC	limited value for comparison
M, m	Medulla
maj	major
mand	mandible/mandibular
manuf, mfg	manufactured
max	maxilla
MC	metacarpal
md	median
ME	Medical Examiner
med	medial
med, Med	medium
MeOH	methanol
Mf	manufactured fiber
MI	medullary index
min	minimum
min	minor
misc	miscellaneous
m-l	medial-lateral/medio-lateral
MM	man made
mn	mean
Mod, mod	moderate
MOD	modified
MR	mixed racial
MS	mass spectrometry
MSP	Microspectrophotometry
MT	metatarsal
mtd, mtnd, mt'd	mounted
mtDNA	mitochondrial DNA
MTFVTC	miscellaneous textile fibers, various types and colors
multi	when used in fiber notes or chart, multilobal
n	refractive index
na, N/A	not applicable
Nat	natural
Nat Amer	Native American
n_c	refractive index at hydrogen c line
n_d	refractive index at sodium d line
ndl	nondelustered
nDNA	nuclear deoxyribonucleic acid
n_f	refractive index at hydrogen f line
NS	not suitable, not suitable for meaningful comparison purposes
NSFCP	not suitable for comparison purposes
NSFMCP	Not suitable for meaningful comparison purposes

NSFSCP	Not suitable for significant comparison purposes
NSFSI	not suitable for species identification
N/STF VTC	natural & synthetic textile fibers, various types and colors
NTF	natural textile fiber
num	number
Nut	nutrient
Ob, OB	ovoid body
occ	occasional(ly)
OES	optical emission spectrometry
or, org	orange
orb	orbital
OTFVTC	other textile fibers various types and colors
part	partial/partially
PB, pbx	pill box
pcs	pieces
pf, pfd, ppf, ppfd	paperfold
pg	page
PH	pubic hair
Phal	phanlanx/phalange(s)
pig gran	pigment granules
pig	pigment
Pkg'd	packaged
PLM, pol scope	polarized light microscopy/microscope
poly	polyester
post	posterior
pp	processing plan
ppl	purple
PR	processing room
pred	predominantly
proj	projectile
prot	protrusion
prox	proximal
PS	physical scientist
pt	point
pub	pubis/pubic
R, r, rt	right
rad	radius
r/br	reddish brown
rd, rnd	round, rounded
re	regarding
rec, rec'd	received
rel	relative(ly)

ret'd	returned
RI, ri	refractive index
Rnd, rd	round, rounded
ROW	Rest of World (indicates outside of Iraq and Afghanistan theaters)
rs, RS, R/S	representative sample
rt(s)	root(s)
rzr	razor
S	suspect
S(#)	sacral segment number #
sag	sagittal
scap	scapula
scope	microscope
SCR	silicon controlled rectifier
S/D, S&D	similarities and differences
SE, sec ev, Sec Evid	secondary evidence
SEI	secondary evidence inventory
SEM-EDS	scanning electron microscopy-energy dispersive spectroscopy
sev	several
SF	synthetic fiber
sim	similar
skel	skeletal/skeletal
sl, sld	slide
slt	slight
sm	small
SN, S/N	Serial Number
spec	specimen
SR	Scraping Room
s/r	stretched root
stat	stature
std	standard
str	stretched, stretched root
subtroc	subtrochanteric
sup	superior
sut	suture
sym, symph	symphysis
syn	synthetic
t, th, thk	thickness
T(#)	thoracic vertebra number
TC, telcall, telcal, TX	telephone call
TCI	thread count per inch
tel	telogen
TF	textile fibers
TFVTC	textile fibers, various types and colors

therm	thermal
thor, T	Thoracic
tis	tissue
tpd	tapered
tr	trace
trans	transferred
transl	translucent
trans'l	transitional
transv	transverse
triang	triangular
tri, trl	trilobal
troc	trochanter
trt	treated
tub	tubercle/tuberosity
UNK	unknown
UV	ultraviolet
v	very
V	victim
vac	vacuum filter
var	variable, variation
vert	vertical
verte	vertebra(e)
vis	visible
W, wid	width
w/	with
wht	white
w/o	without
wt	weight
WTF	wig type fiber
xline	crystalline
XRD	X-ray diffraction
XRF	X-ray fluorescence
x-section, x-sect, XS	cross-section
xtl	crystal
yel	yellow
zyg, zygo	zygomatic

Rev. #	Issue Date	History
8	06/20/2018	Added ANa, ICP, LA, NS, NSFMCP, OES, pred. Added dissimilar to ≠. Added stretched to str. Removed abbreviations that are common use and not specific to the laboratory. Removed abbreviations referencing Caucasian, Negroid, and Mongoloid ancestral terms.
9	02/03/2020	Updated SBAU-Trace name in Scope. Changed 'geoloical' to 'geologically-derived' in Scope. Added ∡, Δ, CF, cf, delt, dens, MI, NSFSI, and trans'l. Added 'variation' to 'var.' Duplicate entries deleted.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Casework Assignment and Review Procedures

1 Scope

This document applies to individuals who perform examinations in the following categories of testing:

- Hair
- Fiber and Textiles
- Glass
- Geologically-derived Materials
- Anthropology

2 Assigning Cases in the Trace Evidence Unit

The assignment of casework in the Trace Evidence Unit (TEU) is the responsibility of the Unit Chief (UC) or Supervisor. When a case is being assigned, the following steps are taken:

- If there was a previous submission on the case, the previously assigned Examiner will be assigned in Forensic Advantage (FA). If that Examiner is no longer in TEU, a new Examiner will be assigned by the UC or Supervisor. At the discretion of the UC or Supervisor, new cases with previous submissions can be assigned to a new Examiner.
- If a new Examiner assignment is required, the UC or Supervisor will make the assignment based on the Examiner's caseload and availability.

3 Assigning Cases in the Scientific and Biometrics Analysis Unit - Trace

The assignment of casework in the Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace) is the responsibility of the UC or the Trace Evidence Supervisor. When a case is being assigned, the following steps are taken:

- The UC or Trace Evidence Supervisor will review the request and assign an examiner based on the circumstances of the case.
- If there was a previous submission in the case, the previously assigned Examiner will be assigned in Forensic Advantage (FA). If that Examiner is no longer in SBAU-Trace, a new Examiner will be assigned by the UC or Trace Evidence Supervisor. At the discretion of the UC or Supervisor, new cases with previous submissions can be assigned to a new Examiner.
- If a new Examiner assignment is required, the UC or Trace Evidence Supervisor will make the assignment based on the Examiner's caseload and availability.

4 Case Records

Case records are prepared in accordance with the FBI Laboratory Operations Manual (LOM). Case records consist of all case-related documentation that support the results and/or conclusions presented in a *Laboratory Report* (7-1, 7-273, 7-1 LIMS, or 7-273 LIMS). The case records contain administrative and examination records for one Examiner. It may be contained in a 1A [*Supporting Documentation Envelope* (7-251)] as a hardcopy, as a digital file(s) uploaded to Sentinel, or as a combination of both hardcopy and digital files.

4.1 Administrative Records

Records that do not pertain to the conclusions of the examinations performed are considered administrative records. The Laboratory number must be present on each administrative record page.

The following are defined as administrative records in the Trace Evidence Unit and Scientific and Biometrics Analysis Unit - Trace:

- Laboratory Work Sheet (7-2) (Legacy)
- Search Slip (Legacy)
- Chain-of-Custody Log (7-243 and/or 7-243a) or FA Chain of Custody
- Secondary Evidence Inventory (Legacy or FA) or Secondary Evidence Log
- Activity and Communication Log (7-245) or Case Record Communication Log
- Copy of Request for Examination
- Case Record Report
- Explanation and approval for any minor deviations from SOPs or a Major Deviation Request (7-258), if applicable

4.2 Examination Records

Examination records are notes, forms, printouts, charts, and other records that pertain to the conclusions of the examinations performed. The following are defined as examination records in the Trace Evidence Unit and Scientific and Biometrics Analysis Unit - Trace:

- Physical Scientist notes
- Examiner notes
- Verification form (Legacy only)
- Fiber chart
- Instrument printouts
- Photographs

4.3 Hardcopy Case Records

At the time of the technical and administrative review, all records generated under one request for examination must be accounted for in their entirety. When information is on two sides of a piece of paper, this counts as two pages.

The following will be done prior to the reviews:

- The Examiner will initial each page of the examination records to indicate that he or she has reviewed each page.
- Number the pages of the examination records in the form "__ of __" or "_/_". Only the first page of the records is required to record the total number of pages (*e.g.*, 1 of 6, or 1/6).
- On the "Description of Enclosures" area of the 1A (7-251) envelope, at a minimum, write the number of pages of examination records present, the number of administrative records present, and check off the types of records enclosed.

Each Examiner is responsible for generating a 1A (7-251) envelope that will contain the hardcopy administrative and examination records for the case. If the material is larger than 8 ½ x 11", it will be placed in an appropriate size box with the filled out 1A (7-251) envelope attached and designated as a 1C. Separate 1A (7-251) envelopes must be generated for each Examiner. Information from the 1A (7-251) will be added into Sentinel and the 1A (7-251) serial number generated will be recorded on the 1A (7-251).

4.4 FA Case Records

If examination records are maintained only in FA, personnel preparing the examination records will record agreement with the content by approving the record within the Case Record Object Repository. When examination records are prepared by personnel other than the reporting examiner, the examiner will record his/her review of the records within the Case Record Communication Log.

The FA Publish and Packet Manager will be used to generate and account for all FA administrative and examination records included in a Case Record 1A. This electronic file will then be uploaded into Sentinel and serialized.

5 Verification and Blind Verification of Examination Results

Refer to specific category of testing procedures for verification or blind verification procedures and records. For Legacy cases, verifications will be recorded on the Verification Form (Refer to Appendix A). Verifications for cases in FA will be recorded in FA.

Prior to a *Laboratory Report* being issued, an examiner may disseminate expedited results or partial results of an examination per *LOM – Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA).* Results not requiring verification or blind verification according to the specific category of testing procedure do not require verification prior to dissemination.

6 Review Procedures

6.1 Technical Review Procedures

All *Laboratory Reports* (7-1, 7-273, 7-1 LIMS, or 7-273 LIMS) written by TEU or SBAU-Trace Examiners will be technically reviewed by a Technical Leader or Examiner qualified in that category of testing prior to the administrative review. Once an individual is qualified to perform examinations in a specific category of testing, they are authorized to perform technical reviews of reports within that category of testing. The technical review will be carried out as described in the LOM - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA)* or LOM - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases*.

6.2 Administrative Review Procedures

All *Laboratory Reports* written in TEU and SBAU-Trace will be administratively reviewed prior to the report being issued. The Unit Chief, Supervisor, or an Examiner will perform the administrative review. The administrative review will be carried out as described in the LOM - *Practices for Preparing, Reviewing, and Issuing Reports and Retaining Records in Forensic Advantage (FA)* or the LOM - *Practices for Preparing, Reviewing, and Issuing Reports and Retaining Records for Legacy Cases.* If the administrative reviewer is also qualified in the category of testing of the *Laboratory Report,* they may conduct the technical review, verification of identifications and associations, and the administrative review.

6.3 Record of Technical and Administrative Reviews

6.3.1 Technical and Administrative Reviews – FA Cases

Upon completion of the technical review, the reviewer will record their agreement with the examination process in FA. Upon completion of an administrative review, the reviewer will record their approval of the *Laboratory Report* in FA. If the technical and administrative reviews

are conducted by the same person, the reviewer will record their approval with the examination process and of the *Laboratory Report* in FA.

6.3.2 Technical and Administrative Reviews – Legacy Cases

Record of the technical and administrative reviews will be on the file copy of the *Laboratory Report* as follows:

If the technical and administrative reviews are conducted by the same person, then the following will be used:

Technical and Administrative Reviewer_____ Date_____

If the technical and administrative reviews are not conducted by the same person, then the following will be used:

Technical Reviewer _____ Date_____

Administrative Reviewer _____ Date_____

7 References

- FBI Laboratory Operations Manual.
- FBI Laboratory Quality Assurance Manual.

Rev. #	Issue Date	History
4	10/02/2017	Changed title and added Section 1 to reflect discipline scope. Renumbered subsequent sections. Section 2 - Removed designee. Added Section 3 to address assigning cases in SAU-Trace. Renumbered subsequent sections. Sections 4, 4.1 and 4.2 - added definitions of case records, administrative records and exam records and indicated that it applied to records generated in TEU and SAU-Trace. Sections 4.3 and 4.4 - reorganized into sections dealing with hardcopy case records and FA digital case records. Section 5 - Removed confirmation and changed to Verification and Blind Verification Sections 6-6.3.2 - updated from *Report of Examination* to *Laboratory Report* and updated practice titles. Updated wording of document for clarity. Added to Section 6.1 who may perform technical reviews. Section 4.4 from previous numbering deleted.
5	02/03/2020	Removed Trace Evidence from the title. Changed 'geological' to 'geologically-derived' in Scope. Updated SBAU-Trace name throughout. Updated Section 2. Added 'Secondary Evidence Log' to list in Section 4.1. Removed language 4.4, and 6.1 that is covered in the LOM. Added language to address expedited results requiring verifications in Section 5. Changed 'able' to 'authorized' in Section 6.1.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

Redacted - Signatures on File

QA Approval

Quality Manager: Date: 01/31/2020

Appendix A: *Trace Evidence Verification Form (Legacy)*

Redacted - Form on File

Continuing Education and Additional Post-Qualification Training

1 Introduction

This document provides guidance on additional training needs for Trace Evidence personnel who have already met their initial training requirements and have been qualified and authorized by the FBI Laboratory. This document identifies the circumstances when additional training is necessary. It also provides the yearly requirements for continuing education and specifies the steps necessary to evaluate the effectiveness of the training.

2 Scope

This document applies to individuals who perform examinations in the categories of testing of hairs, fibers and textiles, glass, geologically-derived materials, and anthropology.

3 Additional Post-Qualification Training Requirements

Additional training is required of qualified personnel who have already met their initial training requirements under the following circumstances:

3.1 When an individual has been absent from work and not performing the duties for which they are qualified for longer than 6 months, the individual will be required to review the training materials for their category(ies) of testing. Additionally, the individual will take are qualification test prior to resuming independent casework. Re-training may be deemed necessary for absences of less than 6 months at the discretion of the individual's assigned Unit Chief (UC), Technical Leader (TL), or Supervisor.

3.2 If an individual is found to lack sufficient knowledge in a category of testing, they are required to review the training materials for the area in which they have been found to be deficient. Deficiencies may be identified during technical and/or administrative reviews, audits, quality control checks, or in the process of proficiency testing. The re-training may include supervised laboratory work. The individual must pass a requalification test prior to performing independent casework again. In addition, the FBI Laboratory Operations Manual - *Practices for Open Proficiency Testing* and/or the *Practices for Addressing a Nonconformity* must be followed, as appropriate.

3.3 When a new procedure is being implemented.

3.3.1 When a new procedure is issued, the standard operating procedure (SOP) must be reviewed by individuals that will follow that SOP. As needed, training can be provided by vendors of newly acquired instrumentation or software.

3.3.2 All affected personnel must pass a competency test that includes the new method/procedure prior to using it in casework. For personnel involved in the validation process, the UC and the TL, may approve the validation to serve as demonstration of competency. This approval will be recorded.

4 Continuing Education

Individuals who perform examinations in hair, fiber and textiles, geologically-derived materials, glass, and anthropology have the following requirements for continuing education:

- 15 hours of annual training per performance rating year.
- Training must relate to job performance.
- Training includes both traditional and non-traditional learning opportunities.
- The assigned UC or Supervisor will consider training requests based on employee work demands and financial resources available. All continuing education credits are approved by the assigned UC or Supervisor.
- Independent learning opportunities and training are permitted during work hours or adjusted work hours in order for an employee to participate in training that is being paid for by that individual with approval from the assigned UC or Supervisor.
- Employees are responsible for maintaining records supporting the completion of learning activities.

5 References

- FBI Laboratory Quality Assurance Manual.

- FBI Laboratory Operations Manual.

Rev. #	Issue Date	History
3	10/02/2017	Section 1 - Updated wording for clarity. Section 2 - Added Scope and changed from unit based to personnel conducting exams in hairs, fibers, geologically-derived materials, glass, and anthropology. Old Sections 2 and 4 combined into Section 3 - delineated it applies to personnel post-qualification. Renumbered rest of sections. Sections 4 and 4.1 - Updated to include who section applies to and allows for the assigned Supervisor to consider training requests and method for evaluation of effectiveness of training. Removed reference to physical scientist close-out interview.
4	02/03/2020	Removed Trace Evidence from the title. Changed ‘geological’ to ‘geologically-derived’ throughout. Changed he/she to they and her/him to their throughout. Removed previous Section 4.2 regarding evaluating effectiveness of training.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Procedures for Calibration and Maintenance of Instruments

1 Introduction

Instruments used in the Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace) that require calibration and/or performance monitoring are listed below. For specific guidelines regarding the calibration procedures for the instrument, including the origin and certification of specific instrument standards, please refer to the referenced protocols.

2 Scope

This document applies to individuals within the TEU and SBAU-Trace who perform examinations in the categories of testing of hairs, fibers and textiles, glass, geologically-derived materials, and anthropology.

3 Instruments Requiring Internal Calibration/Alignment Verification (Complete list of instruments maintained within the appropriate unit)

The following instruments used in the TEU and/or SBAU-Trace require internal calibration/alignment verification:

3.1 Microspectrophotometers

3.1.1 Refer to the *Performance Monitoring Protocol for Microspectrophotometers* for guidance on calibration verification.

3.1.2 Verification of calibration of the instrument is performed each day the instrument is used. Refer to the *Performance Monitoring Protocol for Microspectrophotometers* for acceptance criteria.

3.1.3 Calibration verification records will be maintained with the instrument.

3.2 Fourier Transform Infrared Spectrometers

3.2.1 Refer to the *Performance Monitoring Protocol for FT-IR Systems* for guidance on calibration verification.

3.2.2 Verification of calibration of the instrument is performed each day the instrument is used. Refer to the *Performance Monitoring Protocol for FT-IR Systems* for acceptance criteria.

3.2.3 Calibration verification records will be maintained with the instrument.

4 Instruments Requiring Internal Calibration (Complete list of instruments maintained within TEU)

4.1 Glass Refractive Index Measuring System (GRIM3)

4.1.1 Refer to the *Refractive Index of Glass by GRIM* protocol for guidance on calibration.

4.1.2 The GRIM3 is calibrated to manufacturer's specifications annually or as needed. Refer to the *Refractive Index of Glass by GRIM* protocol for specific acceptance criteria.

4.1.3 Calibration records will be maintained adjacent to the instrument.

4.2 ThermoFisher iCAP 6500 Duo Inductively Coupled Plasma – Optical Emission Spectrometer (ICP-OES)

4.2.1 Refer to the *Elemental Analysis of Glass by Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES)* protocol for guidance on calibration.

4.2.2 At a minimum, the ICP-OES is calibrated prior to each analytical run. Refer to the *Elemental Analysis of Glass by Inductively Coupled Plasma – Optical Emission Spectrometry (ICP-OES)* for specific acceptance criteria.

4.2.3 Calibration records will be maintained in the case files when ICP-OES is performed.

5 Instruments Requiring External Calibration/Alignment (Complete list of instruments maintained within the appropriate unit)

5.1 Balances

5.1.1 Balances are calibrated on an annual basis by an ISO 17025 accredited laboratory to manufacturer's specifications.

5.1.2 Certificates of calibration will be maintained with the instrument.

5.2 Micrometers/Calipers/Gauges

5.2.1 These are calibrated on an annual basis by an ISO 17025 accredited laboratory to manufacturer's specifications, if used for critical measurements.

5.2.2 Certificates of calibration dates will be maintained in Resource Manager

5.3 Balance Weights

5.3.1 These weights are recertified on a biennial basis by an ISO 17025 accredited laboratory to manufacturer's specifications.

5.3.2 Certificates of conformance will be maintained on the FBI intranet.

6 Instruments Requiring Maintenance

6.1 Microscopes are cleaned and serviced yearly by an outside vendor. A list of microscopes by unit requiring yearly maintenance will be maintained within the appropriate unit. A microscope will not be considered out of service unless it has not been serviced within a year and a half of its last service.

6.1.1 Microscopes used for trace evidence examinations at a non-FBI Laboratory controlled space will be assessed prior to use. This assessment will include performing modified Kohler illumination and color balancing, if appropriate. This assessment will be recorded in the examination notes. Any irregularities observed during this assessment will also be recorded in the examination notes.

Rev. #	Issue Date	History
4	10/02/2017	Updated title and throughout to delineate that document applies to TEU and SAU-Trace. Added Section 2 Scope and renumbered. Sections 3, 4, 5, 6 updated to reference SAU Instrument Operations Group or Property Manager. Updated titles of SOPs referred to throughout document.
5	02/03/2020	Updated SBAU-Trace group name throughout. Changed 'geological' to 'geologically-derived' in Scope. Changed lists to be maintained within units. Updated TE QA document names throughout. Updated wording in Sections 4.1.2 and 6. Added section 6.1.1. Removed all reference to PANalytical X'Pert Pro XRD. Added calibration/certification specifications and laboratory requirements to Sections 5.1.1, 5.2.1, and 5.3.1.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Open Proficiency Testing Procedures

1 Introduction

The Proficiency Test Representative (PTR) of the Trace Evidence Unit (TEU) and the PTR of the Scientific and Biometrics Analysis Unit (SBAU) will distribute, evaluate and record proficiency tests for their units, respectively. This document supplements the requirements for proficiency testing outlined in the FBI Laboratory Quality Assurance Manual (QAM) and FBI Laboratory Operations Manual (LOM) - *Practices for Open Proficiency Testing*.

2 Scope

2.1 Personnel conducting examinations in the following categories of testing will follow this document:

- Hairs
- Fibers and Textiles
- Geologically-derived materials
- Glass
- Anthropology

The following categories of testing will be tested once per year and the tests will be prepared internally or purchased externally as identified below:

Categories of Testing	Source
4.7 Hair	External
4.3 Fibers and Textiles	External
4.15 Hair and Fiber Debris screening	Internal
Anthropology	Internal and/or external
4.6 Glass	External
4.15 Geologically-derived materials	Internal

2.2 Each qualified hair examiner will be tested annually in the area of human hair analysis and comparison. All hair proficiency tests will be purchased from an approved external provider and the test approved for use by the Technical Leader and the Quality Manager.

2.3 Each qualified fiber examiner will be tested annually in the area of fiber analysis and comparison. All fiber proficiency tests will be purchased from an approved external provider and the test approved for use by the Technical Leader and the Quality Manager.

2.4 Each qualified glass examiner will be tested annually in the area of glass analysis and comparison. All glass proficiency tests will be purchased from an approved external provider and the test approved for use by the Technical Leader and the Quality Manager.

2.5 Each qualified geologically-derived materials examiner will be tested annually in the area of geologically-derived materials analysis and comparison. All geologically-derived materials tests will be prepared and administered internally unless an approved external provider is identified and the test is approved for use by the Technical Leader and the Quality Manager. The appropriate PTR will prepare and administer the geologically-derived materials proficiency tests. If the PTR is required to be tested, the PTR must take a geologically-derived materials test prepared by another individual.

2.6 Each qualified anthropology examiner will be tested annually in the area of anthropological analysis. Anthropology tests may be prepared and administered internally, or by an external provider approved for use by the Technical Leader and the Quality Manager. For internal tests, the appropriate PTR will prepare and administer the anthropology proficiency tests. If the PTR is required to be tested, the PTR must take an anthropology test prepared by another individual.

2.7 Each Physical Scientist (PS) will participate annually in at least one proficiency test in the area of debris screening. All debris screening tests will be prepared and administered internally unless an approved external provider is identified and the test is approved for use by the Technical Leader and the Quality Manager. The appropriate PTR or Supervisor of the unit which the PS is assigned to will prepare and administer the debris screening tests. If the PTR or Supervisor is required to be tested, the preparer must take a debris screening test prepared by another individual. The PS may participate in a test along with their assigned examiner.

3 External Proficiency Testing

3.1 External proficiency tests will be assigned and worked in the proficiency test section of Forensic Advantage (FA). Each Forensic Examiner (FE) will process and conduct the appropriate examinations on the items in their proficiency test as they would for normal casework. The FE will prepare a *Laboratory Report* (7-1 LIMS or 7-273 LIMS) and complete all sections of the external provider's results form.

3.2 Prior to external proficiency tests being distributed to the test participant, the Technical Leader (TL) will review the external proficiency test design. If the design of the test will require departure from standard procedures or additional instruction, the TL will provide this information to the test participants to ensure consistency amongst participants. This communication will be recorded.

4 Internal Proficiency Testing

4.1 When an outside provider is unavailable for a category of testing an internal test will be designed.

4.2 The PTR will coordinate with the appropriate technical leader to design the necessary tests, prepare samples, and prepare tests according to the LOM - *Practices for Open Proficiency Testing.*

4.3 Internal proficiency tests will be assigned and worked in the proficiency test section of Forensic Advantage (FA). Each PS will process the items in their proficiency test as they would for normal casework, and will generate appropriate notes, photos, and secondary evidence. Each FE will process and conduct the appropriate examinations on the items in their proficiency test as they would for normal casework. The FE will prepare a *Laboratory Report* (7-1 LIMS or 7-273 LIMS).

5 Preparation of an Internal Debris Screening Test

5.1 Each debris screening test will be accompanied by a request for examination from a contributing agency that describes the submitted items and any available names of suspect(s) and/or victim(s). The preparer of the test will generate the request for examination and add it to the case object repository in FA. The letter will also indicate the examinations that need to be performed.

5.2 The test design will follow the most current approved design(s).

5.3 The proficiency test will be provided by the appropriate PTR to each test participant.

5.4 An Open Proficiency Test Sample/Test Preparation Form (Appendix A) will be completed by the appropriate PTR or Supervisor. This form will be maintained with the proficiency test records.

6 Preparation of an Internal Soil Proficiency Test

6.1 Each soil proficiency test will be accompanied by a request for examination from a contributing agency that describes the types of submitted items and any available names of suspect(s) and victim(s). The letter will indicate the examinations needed in the case. The test preparer will prepare the request for examination and add it to the case object repository in FA.

6.2 The test design will follow the most current approved design.

6.3 The proficiency test will be provided by the PTR to each test participant.

6.4 An Open Proficiency Test Sample/Test Preparation Form (Appendix A) will be completed by the PTR or Supervisor. This form will be maintained with the proficiency test records.

7 Preparation of an Internal Anthropology Proficiency Test

7.1 Each anthropology proficiency test will be accompanied by a request for examination from a contributing agency that describes the types of submitted items and any available names of suspect(s) and victim(s). The letter will indicate the examinations needed in the case. The test preparer will prepare the request for examination and add it to the case object repository in FA.

7.2 Anthropology proficiency tests will include one or part of the types of anthropological examinations conducted at the FBI Laboratory. Biological profiles and trauma analyses do not require the submission of known specimens.

7.3 The test design will follow the most current approved design.

7.4 The proficiency test will be provided by the PTR to each test participant.

7.5 An Open Proficiency Test Sample/Test Preparation Form (Appendix A) will be completed by the PTR or Supervisor. This form will be maintained with the proficiency test records.

8 Reporting and Evaluation of Proficiency Tests

8.1 Reporting of proficiency test results will follow the requirements in the LOM - *Practices for Open Proficiency Testing* and those of the external proficiency test provider, when applicable.

8.2 All proficiency tests will be technically and administratively reviewed and verified using the same procedures applied to casework, where appropriate. Debris screening proficiency tests will be technically and administratively reviewed prior to submission. This review will be recorded in the Case Record Communication Log.

8.2.1 Completed external provider data sheets will be included in the administrative and technical review process. The results of internally designed proficiency tests will be reported in Forensic Advantage (FA).

8.3 The appropriate PTR will evaluate each completed test in compliance with LOM - *Practices for Open Proficiency Testing*. If the PTR is being tested, the appropriate Unit Chief or Supervisor will perform the evaluation of the PTR's results.

8.4 Refer to the LOM - *Practices for Open Proficiency Testing* for procedures on recording the evaluation of results.

9 Proficiency Test Records

9.1 All appropriate proficiency test records as defined in the LOM - *Practices for Open Proficiency Testing* will be maintained in FA.

9.2 All samples from proficiency testing will be stored in an appropriate container. These will be maintained in a location designated by the appropriate PTR or Unit Chief for at least one proficiency test cycle.

9.3 Records of internal test design, internal sample preparation, and internal test preparation will be maintained by the appropriate PTR.

10 References

- FBI Laboratory Operations Manual - *Practices for Open Proficiency Testing*.
- FBI Laboratory Quality Assurance Manual.

Rev. #	Issue Date	History
7	12/12/2018	Added Section 3.2.
8	02/03/2020	Updated SBAU-Trace name in Scope. Changed ‘geological’ to ‘geologically-derived’ throughout. Updated Section 3.1 to clarify. Added Section 4.3. Added review requirements to Section 8.2.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Appendix A: *Trace Evidence Open Proficiency Test Sample/Test Preparation Form*

Redacted - Form on File

Documentation of Items Used As Reference Materials, Known Materials, and Reference Collections

1 Scope

This document describes the procedures for the use, documentation, and verification of reference and known materials utilized to ensure the integrity of the materials through proper storage and use. This document applies to individuals who perform examinations in the categories of testing of hairs, fibers and textiles, geologically-derived materials, glass and anthropology.

2 Definitions

A reference material is material, sufficiently homogeneous and stable with reference to specified properties, which has been established to be fit for its intended use in measurement or in examination of nominal properties.

A known material[1] is an item from an identified source. Known materials may be acquired for the purpose of comparison with an evidentiary sample or for inclusion in reference collection(s) utilized in training and/or to assist in identification in casework.

3 Reference and Known Materials Utilized by the Trace Evidence Unit (TEU) and/or Scientific and Biometrics Analysis Unit-Trace (SBAU-Trace)

3.1 Reference Materials

- Float Glass Reference Material (National Institute for Standards and Testing [NIST] standard reference material [SRM] 1831)
- Float Glass Reference Material (Bundeskriminalamt [BKA] FGS 1 from SCHOTT Glass, Germany)
- Float Glass Reference Material (BKA FGS 2 from SCHOTT Glass, Germany)
- Float Glass Reference Material (BKA DGG from SCHOTT Glass, Germany)
- Container Glass Reference Material (NIST SRM 621)
- 1000 µg/ml Scandium Spectrometric Standard Solution (NIST-traceable)

[1] This is similar to, but distinguished from, using sampling to take a representative portion of an evidentiary sample and labeling it as a Known (*e.g.*, taking a known sample of a piece of evidentiary fabric).

- Glass Refractive Index Reference Material, (NBS melt 9012, or equivalent)
- Glass Refractive Index Reference Material, (BKA K5, from SCHOTT Glass, Germany)
- Locke Scientific standard reference glasses (Locke B1 through B12, Locke A1 through A5, Locke C1 and Locke C1, or equivalent)
- Holmium oxide Suprasil7 standard
- Didymium Suprasil7 standard
- Neutral density 0.1 Suprasil7 standard
- Neutral density 0.5 Suprasil7 standard,
- Neutral density 1.0 Suprasil7 standard
- XRD (X-ray diffractometry) Flat Plate Intensity Standard (NIST SRM 1976)
- Pressed Silicon Powder XRD Line Position and Line Profile Standard
- Polystyrene Standard: 1.5mil (38 micron) matte-finish film mounted on a card (Traceable and/or non-traceable) (see section 3.1 of *Performance Monitoring Protocol for FT-IR Systems*)
- Standards Wheel in Nicolet 6700 or is50 Spectrometer Bench: 1.5mil (38 micron) matte-finish NIST traceable polystyrene standard and 1.0mil Schott NG11, National Physical Laboratory (NPL) traceable optical glass reference installed within the bench
- Pinhole Slide: Slide containing a metal disk with a 100 micron pinhole, an open hole approximately 11mm in diameter, and a 14mm diameter gold
- XRF (X-ray Fluorescence) Calcium Hydroxyapatite Standard (NIST SRM 2910-a)

3.2 Known Material Reference Collections

- Cordage
- Fabric
- Animal Hair
- Human Hair

- Fibers
- Kitty litter
- Building materials
- Rocks
- Minerals
- Safe Insulation
- Glass
- Skeletons
- Skeletal Casts
- Histological slides

4 Standards and Controls

4.1 Reference materials will be traceable to SI units or to certified reference materials, where practicable.

4.2 Reference materials will be used only during their certification period, if applicable.

4.3 The holmium oxide, didymium, and neutral density Suprasil7 standards must be returned for re-certification after the end of their certification period.

4.4 Reference materials will be used as described in the individual standard operating procedures requiring their use.

5 Storage

5.1 Reference materials and reference collections should be stored in an appropriate container and stored according to manufacturer instructions, if any.

5.2 Liquid reference materials will be stored in tightly closed containers.

6 References

- Trace Evidence Procedures Manual, *X-ray Powder Diffractometry Using X'Pert MPD*.
- Trace Evidence Quality Manual, *Performance Monitoring Protocol for Microspectrophotometers*.
- Trace Evidence Quality Manual, *Performance Monitoring Protocol for FT-IR Systems*.
- Trace Evidence Quality Manual, *Evidence Handling Procedures*.
- Trace Evidence Procedures Manual, *Refractive Index and Dispersion of Glass*.
- Trace Evidence Procedures Manual, *Elemental Analysis of Glass by Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES).*
- Chemistry Unit Instrument Operation and Support Subunit, *Performance Monitoring Protocol (QA-QC) for the Thermo Nicolet FTIRs*.
- FBI Laboratory Quality Assurance Manual.
- FBI Laboratory Operations Manual.

Rev. #	Issue Date	History
3	12/12/2018	Removed Trace Evidence from Title. Updated Known Materials Reference Collection List to remove feathers, wood, and seeds and add skeletons.
4	02/03/2020	Updated SBAU-Trace name in Scope and throughout. Changed ‘geological’ to ‘geologically-derived’ in Scope. Updated TE QA document titles throughout. Updated lists in Sections 3.1 and 3.2.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Validation of Technical Procedures

1 Introduction

Forensic laboratories must implement procedures to ensure that a selected analytical protocol is capable of producing accurate and reliable results. To demonstrate the performance of a technical procedure, a validation study is performed. A validation study involves evaluation of specific analytical parameters, such as accuracy and/or limit of detection. The Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace) will define an acceptable range for each of the parameters evaluated. When the selected parameters of an analytical method have been demonstrated to fall within the acceptable ranges and appropriately reviewed, the method is considered validated and can be adopted into the trace evidence (TE) standard operating procedures for routine use. This document provides guidelines for the development and validation of new analytical procedures in the TEU and SBAU-Trace.

2 Scope

This document applies to personnel who develop and validate new technical procedures that will be implemented in the TEU and SBAU-Trace. The performance characteristics that are evaluated will be based on the requirements of the analytical procedure.

3 Records

All records related to instrumental validation studies conducted within the TEU and SBAU-Trace will be maintained with the instrument log books for that instrument. All records related to method validation will be kept as a separate file and maintained in the unit for the TEU and/or SBAU-Trace. This includes any relevant journal articles, instrument optimization charts, or validation data used or generated as part of the validation study.

Instrumental validation studies for newly acquired Fourier Transform Infrared spectrometer (FTIR) systems will be recorded on the *Validation Study for Newly Acquired FT-IR Form* (Appendix A).

4 Validation Process

Validation studies are conducted under the direction and management of an appropriate Technical Leader according to the requirements set forth in *LOM – Practices for Developing Methods and Validating Technical Procedures*. The validation study will include:

4.1 Definition of the scope of the analytical procedure.

4.2 Identification of the characteristic(s) of the technical procedure to validate.

4.3 Optimization of analytical parameters and select experiments to determine the required characteristic(s).

4.3.1 Standardized Technical Procedures

A standardized technical procedure has been documented, validated, and endorsed by a recognized technical organization (e.g., ASTM, AOAC, EPA, USP). In this case, the sample preparation and instrumental parameters have been established, so the only experiments required are those that will demonstrate that the technical procedure can be duplicated within the TEU and/or SBAU-Trace and that similar performance characteristics can be achieved.

4.3.2 Modified Standardized Technical Procedures

A modified standardized technical procedure is one that has been modified outside the specifications of the standardized procedure. In this case, it must be verified that the modifications do not alter the performance characteristics such that the data are no longer appropriate for the intended purpose.

4.3.3 Non-standardized Technical Procedures

A non-standardized technical procedure has been developed externally but has not been previously endorsed by a recognized technical organization (e.g., an analytical procedure published in a technical journal). In this case, the performance characteristics applicable to the intended purpose must be determined and appropriate validation experiments must be conducted.

4.3.4 In-house Technical Procedures

An in-house technical procedure is developed within the TEU and/or SBAU-Trace for subsequent routine use or as a solution to a unique analytical problem. In this case, the performance characteristics applicable to the intended purpose must be determined and appropriate validation experiments must be conducted.

4.4 Conduct experiments to determine the required characteristic(s).

4.5 Technical Review and Approval

Upon completion of the method development and/or validation the validation results will be reviewed, and approval will be recorded according to the FBI Laboratory Operations Manual (LOM) – *Practices for Developing Methods and Validating Technical Procedures.*

5 Competency Testing

All examiners and/or physical scientists who will apply the new procedure to casework must successfully complete competency testing requirements set forth in the LOM - *Developing Methods and Validating Technical Procedures.*

6 Procedure Modifications

There are times when deviating from an established standard operating procedure is necessary. When a deviation occurs, the step-by-step procedures that were used must be documented as stated in section 3, as well as the appropriate approval for deviation as follows:

6.1 Significant Modifications to Previously Validated Procedures

If a significant modification has been made to a previously validated procedure, at a minimum, the modification will be evaluated by comparison of established results with those generated by the current procedure using appropriate samples. These modifications should produce results of the same or improved quality as compared with those obtained by the previously validated procedure. Significant modifications records and approval will be done in accordance with major deviation requirements set forth in the LOM - *Practices for Authorizing Deviations*. Any deviations to procedures must be approved by the appropriate Technical Leader prior to their submission to the Forensic Analysis Support Unit.

6.2 Minor Modifications to Previously Validated Procedures

A minor modification to an existing procedure that does not materially affect the performance of the test does not require additional validation studies. These modifications should improve the efficiency, effectiveness, and/or quality of the test. Minor modification records and approval will be done in accordance with minor deviation requirements set forth in the LOM - *Practices for Authorizing Deviations*.

7 References

- FBI Laboratory Quality Assurance Manual.
- FBI Laboratory Operations Manual.

Rev. #	Issue Date	History
3	05/11/2018	Added Validation Study for Newly Acquired FT-IR form in Appendix A and reference to form in documentation section. Section 4.5 modified wording for approval in accordance with LOM.
4	02/03/2020	Updated SBAU-Trace name in Scope and throughout. Changed Section 3 from Documentation to Records in title and throughout. Updated language in Sections 3, 4, and 5.

Approval Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Appendix A: *Validation Study for Newly Acquired FT-IR*

Redacted - Form on File

Appendix A: ***Validation Study for Newly Acquired FT-IR*** **(cont.)**

Redacted - Form on File

Appendix A: ***Validation Study for Newly Acquired FT-IR*** **(cont.)**

Redacted - Form on File

Administrative Structure and Operating Guidelines

1 Scope

1.1 The Trace Evidence Unit (TEU) is assigned to the Scientific Analysis Section of the FBI Laboratory. The Unit is composed of a Unit Chief (UC), Technical Leader (TL) for each category of testing, Supervisory Physical Scientist-Forensic Examiners (SPS-FE), Physical Scientist-Forensic Examiners (PS-FE), Geologist-Forensic Examiners (G-FE), Physical Scientists (PS), and contractors. The administrative structure is designed to clearly define a chain-of-command and to establish corresponding responsibilities and duties.

1.2 The Scientific and Biometrics Analysis Unit (SBAU) is assigned to the Terrorist Explosive Device Analytical Center (TEDAC) Section of the FBI Laboratory. The Unit is composed of a UC, Management and Program Analysts (MAPA), SPS-FEs, PS-FEs, PSs, Supervisory Biologist-Forensic Examiner (SB-FE), Biologist-Forensic Examiners (B-FE), Biologists, Chemist Non-Examiners (C-NE), and contract staff as required. The administrative structure of the SBAU is designed to clearly define a chain-of-command and to establish corresponding responsibilities and duties.

1.2.1 SBAU-Trace is a group within SBAU that performs analysis in the categories of testing of hairs and fibers and textiles. The SBAU-Trace group is composed of a SPS-FE, PS-FEs, and PSs.

1.3 This document applies to individuals assigned to the TEU and SBAU-Trace.

2 Mission Statements

2.1 The TEU provides scientific examinations of physical evidence in the areas of hairs, fibers, fabric, cordage, glass, geologically-derived materials, and skeletal material; expert testimony relating to these examinations in legal proceedings; training to the law enforcement community; forensic field support in FBI cases; and develops and implements new technologies to enhance scientific examinations.

2.2 The SBAU conducts latent print, DNA, trace, and toolmark analysis and related instrument operation support to provide actionable intelligence from IED materials to the United States Government and its partners in a continual effort to access, defeat, and counter the IED threat**.** Results are delivered for use in actionable intelligence and investigations, and SBAU continuously seeks to enhance its current exploitation capabilities through the development and utilization of innovative and novel scientific methods and techniques.

3 Organizational Structure

3.1 The TEU is divided into three groups: Anthropology, Hair and Fiber, and Mineralogy. Personnel are assigned to a group based on their position description.

3.1.1 The Hair and Fiber group performs analysis within the following categories of testing: Hairs, Fibers and Textiles, and General Physical and Chemical Analysis. The subcategory of testing under General Physical and Chemical Analysis is debris screening for hairs and fibers.

3.1.2 The Anthropology group performs analysis within the following category of testing: Anthropology.

3.1.3 The Mineralogy group performs analysis within the following categories of testing: Glass and General Physical and Chemical Analysis. The subcategory of testing under General Physical and Chemical Analysis is Geologically-Derived Materials.

3.1.4 Each category of testing has a TL who may be the TL for more than one category of testing. Each TL reports to his/her UC or assigned supervisor and works with the affected UCs, when applicable, to ensure technical continuity for the category of testing. Qualified SPS-FEs, PS-FEs and G-FEs may serve as the TL in their category of testing. A UC may also serve as a TL if they are a qualified PS-FE within the Hair and Fiber, Anthropology, and/or Mineralogy categories of testing.

3.2 The SBAU-Trace group performs analysis within the following categories of testing: Hairs, Fibers and Textiles, and General Physical and Chemical Analysis. The subcategory of testing under General Physical and Chemical Analysis is debris screening for hairs and fibers.

4 Responsibilities

4.1 Unit Chief

- Manages the daily operation of their unit.
- May perform administrative reviews of reports.
- Conducts annual reviews on all unit employees unless otherwise designated.
- Performs 90-day file reviews with all Forensic Examiners unless otherwise designated.
- Observes and evaluates activities of personnel on a regular basis.
- Sets performance measures by which the Unit's mission is fulfilled.
- Handles special projects from their Section Chief.
- Recommends and approves formal training opportunities for employees to ensure continuing education.
- Maintains regular contact with their Section Chief.
- Oversees Unit meetings.
- Attends their Section meetings.

- Maintains direct contact with other appropriate units within the FBI Laboratory.
- Maintains contact with other appropriate units within the FBI.
- Prepares written and oral communications in conjunction with the field, other divisions, and the law enforcement community.
- Maintains, expands and improves liaison contacts to enhance the attainment of Unit performance measures.
- Provides 24-hour availability to address national and international crises.
- Manages assigned programs according to FBI/DOJ policies, guidelines, and procedures.
- Ensures that their quality assurance program complies with the FBI Laboratory Quality Assurance Manual (QAM) and FBI Laboratory Operations Manual (LOM) requirements.
- Ensures that their unit complies with all FBI policies.
- Ensures that one qualified individual is designated to serve as TL for each category of testing.
- Approves corrective actions after completion of action steps and verification of effectiveness, if required.
- Authorizes major deviations prior to submission to FASU.
- Ensures a list of concession and/or corrections is maintained per the LOM – *Practices for Addressing a Nonconformity*. This list will be reviewed on an annual basis.
- Maintains a list of minor deviations and reviews on an annual basis to determine if any trends are occurring.

4.2 Supervisory Physical Scientist - Forensic Examiner

- Performs administrative reviews of reports.
- Performs technical reviews of casework in their category of testing.
- Makes critical evaluations on the acceptance and assignment of casework to FEs based on expertise and caseload.
- Maintains the case log if required in assigned unit.
- Conducts annual reviews on unit employees they are assigned to supervise.
- Performs 90-day file reviews with all FEs they are assigned to supervise.
- Observes and evaluates activities of personnel they are assigned to supervise on a regular basis.
- Advises UC on performance measures by which the Unit's mission is fulfilled.
- Recommends formal training opportunities for employees to ensure continuing education.
- Provides 24-hour availability to address national and international crises.
- Serves as an FE in the category of testing in which they are qualified.
- Serves as a Subject Matter Expert (SME) for Court Testimony Monitoring for their categories of testing.
- Serves as acting UC, when designated.

- Authorizes minor deviations.

4.3 Technical Leader

- Accountable for technical operations within their category of testing, including training, quality assurance, proficiency testing, and validation.
- Authorizes suspension/termination of operations within their category of testing if it is determined that current casework operations have been compromised or may become compromised. If it becomes necessary to suspend operations, they must notify the affected units UC(s), and are responsible for documenting the situation in an electronic communication (EC) to inform executive management.
- Directs, reviews, and approves all developmental validation, internal validation, or validation of a material modification within their category of testing.
- Manages the research, development, and validation of new technical procedures for use in casework within their category of testing.
- Ensures an annual review is performed of the applicable quality system documents, including the technical standard operating procedures within their category of testing, training, and proficiency testing.
- Approves applicable quality system documents, including the technical standard operating procedures within their category of testing, training, and proficiency testing.
- Performs technical reviews of casework in their category of testing.
- Provides technical expertise and approval to UCs for major deviations and corrective actions.
- Approves corrective actions prior to submission to Forensic Analysis Support Unit (FASU), if required.
- Approves minor deviations of a technical nature under their category(ies) of testing.
- Ensures that PS-FE, G-FE and PS in their category of testing are qualified for their assigned work responsibilities in accordance with the QAM and LOM requirements.
- Serves as a SME for Court Testimony Monitoring for their categories of testing.
- May delegate their duties to a qualified examiner in the same category of testing, but the final work product remains the responsibility of the TL.
- Serves as a Forensic Examiner in the categories of testing in which they are the TL.
- Serves as acting UC, when designated.
- Will inform the UC of any necessary concessions and/or corrections as per the LOM – *Practices for Addressing a Nonconformity*.

4.4 Forensic Examiner

- Receives, assesses and examines evidentiary material.
- Conducts critical evaluation of evidence in order to properly manage examinations performed on cases.
- Performs comprehensive and authoritative analyses of evidence.
- Provides technical leadership and communication with contributors in regard to case acceptance and feasibility of requested examinations.
- Prepares case notes, Laboratory reports, and other relevant communications to document facts pertaining to evidence received, analyses performed, procedures used, and the significance of the results obtained.
- Performs administrative review of Laboratory reports if delegated to do so.
- Performs technical review of Laboratory reports in their category of testing, if requested by TL.
- Researches, develops, and validates new technical procedures for use in casework.
- Prepares and presents ideas, recommendations, conclusions and analytical procedures to peers, superiors, subordinates and the public, including courtroom testimony.
- Trains and mentors new employees in their area of expertise.
- Serves as a SME for the FBI pertaining to the collection, submission, and examination of evidence, as well as courtroom testimony in their category(ies) of testing.
- Provides support and analyses at major crime scenes when necessary.
- Manages a major program within their unit (GS-14 only), where applicable.
- Provides 24-hour availability to address national and international crises.
- Handles special projects assigned by their UC.
- Assists in maintenance of Unit databases in their area of responsibility.
- Serves as acting UC, when designated.
- Serves as acting TL in their category of testing, when designated.

4.5 Physical Scientist

- Receives, assesses, examines, and ensures proper transfer and return of evidentiary material.
- Performs comprehensive analyses of evidence under the supervision of a Forensic Examiner.
- Prepares case notes to document facts pertaining to evidence received, analyses performed, and procedures used.
- Researches, develops, and validates new technical procedures for use in casework.
- Serves as a SME for the FBI pertaining to the collection, submission, and examination of evidence in their category(ies) of testing.
- Trains and mentors new employees in their area(s) of expertise.
- Provides support and analyses at major crime scenes when necessary.

- Handles special projects assigned by their UC.
- Assists in maintenance of Unit databases in their area of responsibility.

4.6 Management and Program Analyst

- Responsible for performing administrative tasks and providing support to unit/program operations and projects.
- Analyze issues relating to the management of administrative/operational programs.
- Perform a variety of management/program analysis functions to identify inefficiencies; streamline processes; eliminate redundancies; evaluate performance measures; and ensure processes meet valid requirements.
- Analyze proposed changes involving the establishment, discontinuance, consolidation, or regrouping of methods and procedures to determine their adequacy and probable effectiveness and to identify overlapping functions or systems.
- Oversee the development of policy; establish policy; evaluate existing policy; and provide solutions to issues that arise.
- Research policies, directives, and regulations to evaluate and develop new ideas and techniques to affect changes in methods, procedures, and the organization.
- Provide guidance and direction to other employees in developing and applying management/program concepts and analytical techniques to operational and technical problems.
- Direct and/or participate in special and ad-hoc projects, working groups, and/or task forces of a widely diverse and complex nature.
- Develop budget estimates and justifications; ensure funds are used in accordance with the operating budget; recommend transfers or reallocation of funding based on rates of expenditure; and compare current and historical information regarding resource allocations to identify trends and determine reasons for same.
- Assess current organizational/program assignments and responsibilities through research, interviews, and observations.
- Determine organizational/program priorities and ensure effective utilization of resources.
- Compile, prepare, present, and defend recommendations, findings, briefings, narrative summaries, and statistical analysis in complex written reports and documents to executive management and external entities.

4.7 Contractor

Contractors are employed on a contractual basis based on unit needs and may perform tasks similar to the Forensic Examiners or Physical Scientists. All contractors will be required to meet the applicable provisions of the FBI Laboratory quality system including successful completion of the appropriate FBI Laboratory training program as well as annual proficiency testing.

5 Personnel Matters

In addition to any requirements set forth by FBI policies, the following procedures are followed:

- All personnel are given an annual performance review. This review is conducted by the appropriate supervisor. Each employee is also given a progress review midway through their rating period.
- Sick leave, annual leave, compensatory leave, and overtime are approved by the appropriate UC or SPS-FE.
- Training, presentations, participation in schools, tours and other matters must be approved by the appropriate chain of command.
- Travel vouchers will be reviewed and approved by the appropriate UC or Supervisor.
- All personnel must annually fulfill and record the continuing education requirement for their category(ies) of testing as described in the Trace Evidence Quality Manual *Continuing Education and Additional Post-Qualification Training*. This training must be approved by the appropriate Unit Chief, or designee.

6 Field Office Assistance/Crime Scene Response

Requests for assistance on crime scenes must be directed to the Unit Chief of the Evidence Response Team Unit. These requests must be approved by the appropriate Unit Chief, who must also seek approval from the appropriate Section Chief.

7 Purchasing Supplies and Services

Federal and FBI Finance Division Procurement Policies and Regulations govern the procurement of products and services from sources external to the FBI. Purchasing priority will be given to Government supply sources including but not limited to the General Services Administration (GSA) wholesale supply source. Supplies, reagents, and consumables must comply, when appropriate, with specifications defined within specific standard operating procedures (SOPs).

7.1 Procurement

Personnel requiring items or the Unit Purchase Card holder will complete a credit card purchase request or requisition, based on total cost, with the needed items and identified vendor. Descriptions of supplies, reagents and consumables ordered will contain enough detail to ensure that items received are adequate for use, if they affect the quality of examinations. After the Unit Chief or Supervisor signs off on the purchase, the individual filling out the purchase request will coordinate with an assigned purchase card holder or, if the unit has one, the Management and Program Analyst (MAPA), for entry into the Purchase Card Authorization and Reconciliation Tool (PCART).

7.2 Receipt and Storage

Supplies, reagents and consumables for the TEU and SBAU-Trace are received through the appropriate Laboratory mailroom, obtained from the Laboratory's Asset Management Group (AMG) or TEDAC Supply Room, or acquired directly from vendors. Procured items will be inventoried when received to ensure accurate fulfillment of request. All purchasing documents should be provided to the purchase card holder, MAPA, and/or the requisition submitter. Purchases will be reconciled in PCART, or appropriate system. Acquired supplies, reagents, and consumables will be stored appropriately (*e.g.*, acids are kept in an acid safe storage cabinet). Adequate supplies to meet immediate needs are kept on hand, and re-stocked as needed.

7.3 Quality of Supplies, Reagents and Consumables

Supplies, reagents and consumables that can affect the quality of analysis must be verified prior to use. If the quality of the new supply, reagent or consumable has not been shown to meet the requirements of the analysis, it will not be used. Materials requiring quality checks prior to use and the method for checking their quality are identified in the individual SOP dictating their use. Quality checks will be recorded, and the documentation will be maintained with the instrument.

In addition, the reliability of critical reagents will be verified at each use. This verification typically consists of use of the reagent during calibration verification and/or preparation of blank samples (see Trace Evidence Procedures Manual *Refractive Index of Glass By GRIM* and *Elemental Analysis of Glass by Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)*) or through the performance of a specific test which is described in the individual procedure (Trace Evidence Procedures Manual *Geologically-Derived Materials Examinations*).

7.4 Approved Suppliers

7.4.1 The following are approved vendors for critical consumables, supplies, and services that may affect the quality of examinations:

Fisher Scientific
- 49% hydrofluoric acid (HF) (Optima Grade, equivalent or better)
- Concentrated hydrochloric acid (HCl) (Optima Grade, equivalent or better)
- Concentrated nitric acid (HNO_3) (Optima Grade, equivalent or better)

Foster & Freeman, LTD. (Locke oils)
High Purity Standards (ICP-OES calibration standards) Spex Certiprep (scandium standards)
VWR Scientific
- 49% hydrofluoric acid (HF) (Optima Grade, equivalent or better)
- Concentrated hydrochloric acid (HCl) (Optima Grade, equivalent or better)
- Concentrated nitric acid (HNO_3) (Optima Grade, equivalent or better) NIST (Hydroxyapatite Standard)

7.5 Services

7.5.1 Service for the TEU Thermo Fisher iCAP 6500 Duo ICP-OES is provided by an approved outside vendor, such as Unity Lab Services.

7.5.2 TEU may contract for additional services with outside vendors as appropriate.

7.5.3 SBAU-Trace contracts for services with outside vendors as appropriate.

Rev. #	Issue Date	History
3	10/02/2017	Changed entire document from unit based to discipline based. Section 1.1 Added Evidence Management Personnel. Section 1.2 Added SAU personnel categories. Section 1.2.1 Identified what SAU-Trace is for purposes of discipline documents Section 1.3 Added section to indicate that this document only applies to SAU-Trace Section 2-2.2 Added. Section 3 Section reorganized to include SAU-Trace and the categories of testing that are performed by individuals within TEU and SAU-Trace. Section 4.1 Removed reference to specific unit and updated UC responsibilities. Section 4.2 Updated title to Supervisory Physical Scientist Forensic Examiner and updated responsibilities. Section 4.3 Updated responsibilities. Sections 4.4, 4.5, and 4.6 Changed verbiage from instructor to SME and removed reference to specific unit where appropriate. Sections 4.7-4.9 Added. Sections 5 and 6 Updated document and position titles. Section 7 Added. Section 9 Added. Section 10 Added.
4	02/03/2020	Removed Trace Evidence from title. Removed all reference to Post Mortem Imaging, Visual Information Specialist, and Evidence Management Unit throughout. Updated SBAU-Trace group name throughout and included job titles in Sections 1.2 and 1.2.1. Changed ‘geological’ to ‘geologically-derived’ throughout. Changed ‘his/her’ to ‘their’ and ‘he/she’ to ‘they’ throughout. Updated wording in Sections 2.2, 3.1, 7, 7.1, 7.2, 7.4.1, 7.5 and the lists in Sections 4.1, 4.2, and 4.4. Added Section 3.2. Updated TE document titles throughout. Removed case acceptance policy.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Evidence Handling Procedures

1 Scope

1.1 This document describes requirements for the handling of physical evidence submitted to the Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace). It applies to individuals who perform examinations in the categories of testing of Hairs, Fibers and Textiles, Glass, Geologically-Derived Materials and Anthropology.

2 Receipt of Evidence

Evidence received in the TEU and SBAU-Trace is typically delivered by appropriately trained personnel to a general storage area. If evidence is received from a carrier (e.g., FedEx), or personally delivered by law enforcement agencies, it must be taken to appropriately trained personnel for initial check in. The TEU or SBAU-Trace personnel retrieving the evidence from general storage will initiate the *Chain-of-Custody Log* (7-243a) for Legacy cases or transfer the case to themselves in Forensic Advantage (FA).

Cases will be reviewed to ensure that the following paperwork is included/available:

2.1 *Chain-of-Custody Log* for Legacy cases only: The evidence will be delivered to general storage by appropriately trained personnel. The personnel retrieving the evidence from general storage will initiate the 7-243a to document the intra-unit transfer(s) of the evidence. This form is retained for inclusion in the *Supporting Document Envelope* or 1A (7-251).

2.2 Request for Examination: If additional information is required prior to processing, the contributor may be contacted. This contact will be recorded on the *Case Activity and Communication Log* (7-245) or the Case Communication Log in FA, as appropriate.

2.3 *Laboratory Work Sheet* (7-2) or *TEDAC Work Sheet* for Legacy cases only: This form will contain a listing of the specimens received and their assigned sample numbers (if present), and is retained for inclusion in the *Supporting Document Envelope* or 1A (7-251).

3 Evidence Inventory in TEU and SBAU-Trace

3.1 After a case is assigned and the evidence has been delivered to the unit, the evidence container(s) and/or packaging will be opened and the contents inventoried. If any of the evidence container(s) and/or packaging is damaged or in an unsealed condition, it will be recorded in the case notes. The decision to proceed with evidence processing will be dependent on the circumstances of the case and the nature of the packaging, and will be determined by an Examiner. If examinations will not be conducted by the unit, the assigned Examiner will issue a

Laboratory Report and include a detailed explanation describing why the requested examination was not conducted per the LOM – Preparing Laboratory Reports and Retaining Records in FA.

3.2 The person receiving the case will check the items received against the itemized listing on the Chain-of-Custody (Legacy or FA) and EXPeRT barcode (if present) on the external container. If a nything is missing or if items are present which are not listed as being delivered, it will be brought to the attention of an Examiner and the appropriate Evidence Management personnel. The description of the items received should be consistent with any information received in the Request for Examination. If any discrepancies are found, the appropriate Evidence Management personnel will be notified.

3.3 Notes will be taken regarding the type and nature of the primary packaging of the submitted item(s). If the primary packaging is not sealed but examinations will still be conducted, the lack of seal will be noted, and the packaging sealed upon completion of the TEU or SBAU-Trace examination.

3.4 Multiple examination requests on submitted items of evidence require that testing be conducted in proper sequence to optimize results and to minimize loss, cross-transfer, contamination, and degradation. If TEU or SBAU-Trace receives evidence that should be examined by another discipline or category of testing prior to a trace evidence examination(s), or after examinations by another discipline or category of testing that prevent a trace evidence examination(s) from being conducted, the appropriate Evidence Management personnel will be notified.

4 Secondary Evidence

Material derived from an item of evidence is designated as secondary evidence. In TEU and SBAU-Trace, examples of secondary evidence include (but are not limited to) the following: glass microscope slides, plastic pillboxes, paperfolds, and vacuum canisters. All secondary evidence for Legacy cases will be accounted for on the appropriate unit Secondary Evidence Inventory (SEI) (Appendices A and B). All secondary evidence for FA cases will be accounted for on the appropriate unit SEI (Appendices C and D) or the FA generated Secondary Evidence Log (SEL).

4.1 Transfers of Secondary Evidence in FA

For FA cases, a new item number(s) will be assigned after secondary evidence has been generated and prior to any transfer of the secondary evidence. The secondary evidence item description will include the name of the discipline or category of testing and the number and type of secondary evidence. Once secondary evidence is assigned an item number(s), it will be transferred in accordance with the LOM - *Practices for Transferring and Storing Evidence*.

4.1.1 The slides generated will be assigned a separate item number from the other secondary evidence.

4.1.2 For TEU, the remaining secondary evidence will be assigned a separate item number(s). For SBAU-Trace, paperfolds will be assigned a second item number, and any remaining secondary evidence a third item number.

4.1.3 For TEU, the SEI or FA generated SEL will be placed into the FA Case Object Repository. For SBAU-Trace, the SEI or FA generated SEL will be placed in the FA Case Record Object Repository.

4.1.4 If any additional secondary evidence is generated after a SEI or a SEL has been created and the secondary evidence assigned item numbers, the SEI or SEL will be updated to reflect the updated totals if a new secondary evidence item(s) is not created.

4.1.5 If any portion of the secondary evidence assigned to an item number needs to be transferred, a new SEI will be generated and that specific portion of the secondary evidence will be assigned a new item number(s), and the original SEI or SEL amended.

4.2 Transfer of Secondary Evidence for Legacy Cases within TEU or SBAU-Trace

When secondary evidence is transferred within the TEU or SBAU-Trace on the *Chain-of-Custody Log*, the following transfers are allowed:

4.2.1 When secondary evidence is transferred in total, the "Item(s)" block on the *Chain-of-Custody Log* will read "TEU Secondary Evidence", "Trace Secondary Evidence", or acceptable abbreviation for Secondary Evidence as listed in the Trace Evidence Abbreviations document of the Trace Evidence Quality Manual.

4.2.2 Transfer of Glass Microscope Slides

4.2.2.1 If the glass microscope slides are transferred in total, the "Item(s)" block on the *Chain-of-Custody Log* will read "all slides" or specifically list what was transferred by Questioned (Q)/Known (K) Number(s) and quantity.

4.2.2.2 If a portion of the slides are being transferred, then the specific specimen number and the number of slides associated with that specimen number will be recorded (*e.g.,* Q1 (2 slides), Q2 (1 slide), K1 (1 slide)). When a portion of the slides is being transferred, all of the slides associated with that specimen number will be transferred (*e.g.,* if specimen Q1 has 2 slides, both slides must be transferred).

4.2.3 Transfer of Pillboxes

4.2.3.1 If the pillboxes are transferred in total, the "Item(s)" block on the *Chain-of-Custody Log* will read "all pillboxes" or specifically list what was transferred by Q/K Number(s) and quantity.

4.2.3.2 If a portion of the pillboxes is being transferred, then the specific specimen number and the number of pillboxes associated with that specimen number will be recorded (*e.g.,* Q1 (2 pillboxes), Q2 (1 pillbox), K1 (1 pillbox)). When a portion of the pillboxes is being transferred, all of the pillboxes associated with that specimen number will be transferred (*e.g.,* if specimen Q1 has 2 pillboxes, both pillboxes must be transferred).

4.2.4 Transfer of Paperfolds

4.2.4.1 If the paperfolds are transferred in total, the "Item(s)" block on the *Chain-of-Custody Log* will read "all paperfolds" or specifically list what was transferred by Q/K Number(s) and quantity.

4.2.4.2 If a portion of the paperfolds is being transferred, then the specific specimen number and the number of paperfolds associated with that specimen number will be recorded (*e.g.,* Q1 (2 paperfolds), Q2 (1 paperfold), K1 (1 paperfold)). When a portion of the paperfolds is being transferred, all of the paperfolds associated with that specimen number will be transferred (*e.g.,* if specimen Q1 has 2 paperfolds, both paperfolds must be transferred).

4.3 Transfers of Secondary Evidence for Legacy cases to Other Units

When secondary evidence is transferred to a different unit by the TEU or SBAU-Trace on the *Chain-of-Custody Log*, all of the secondary evidence will be transferred together. The "Item(s)" block on the *Chain-of-Custody Log* will read "TEU Secondary Evidence", "SBAU-Trace Secondary Evidence", or acceptable abbreviation for Secondary Evidence as listed in the Abbreviations document of the Trace Evidence Quality Manual. This transfer will be accompanied by a completed Secondary Evidence Inventory (Appendix A or B).

4.4 Retained Secondary Evidence

Secondary evidence is retained by SBAU-Trace after examinations are completed for possible future comparison purposes. The secondary evidence is transferred to the appropriate designated archive location (*e.g.,* Afghanistan Slide Archive) after the completion of examinations. Legacy secondary evidence transferred to a final location of evidence storage prior to the creation of the archive locations will be transferred to the appropriate archive location if removed from evidence storage. Evidence storage and archives are located in limited access storage or examination areas and will be protected from loss, contamination, or deleterious change.

4.4.1 For Legacy cases, this will be indicated by the final blocks of the *Chain-of-Custody Log* indicating that the item(s) has been transferred from the person with custody to the appropriate Archive location.

4.4.2 For FA cases, the item(s) will be transferred in FA from the person with custody into the appropriate Archive location as designated by name (*e.g.,* H/F 0301 ROW Slide Archive).

4.4.3 If a current case is compared against previously completed cases (*e.g.,* by searching a database or reviewing case notes) the parameters of the comparison will be recorded in the case notes of the current case (*e.g.,* compared against all previously examined Somalia cases).

4.4.3.1 If items from previously completed cases are removed from evidence storage or an archive location to physically conduct comparisons with the current case, the case notes of the current case will further record the specific items compared by Laboratory number and item/Q number.

4.4.3.2 If secondary evidence is removed from an archive or evidence storage location , this transfer will be recorded on the appropriate chain of custody for Legacy cases or in FA.

5 Databases

SBAU-Trace may utilize internal databases to keep track of characteristics (*e.g.,* color and construction of fabric) useful for identifying items of interest for potential comparison purposes. Database entries and changes will be limited to qualified SBAU-Trace personnel. If appropriate, searches of these databases will be recorded in the case notes.

6 Active Examination

6.1 An active examination is one in which the evidence will be tested, examined, observed, and/or otherwise handled within the next seven working days in TEU and within the next thirty working days for SBAU-Trace.

6.2 When not under active examination, the evidence will be properly sealed and located in a limited access storage or examination area. All secondary evidence not under active examination will be located in limited access storage or examination areas and will be protected from loss, contamination, or deleterious change.

7 Changes to Evidence Description

Any changes to the description of the evidence, including subdivided items, will be added to the *Laboratory Work Sheet* or *TEDAC Work Sheet* for Legacy cases and updated in FA for FA cases. Appropriate evidence management personnel will be notified, as appropriate, of updated information for Legacy and FA cases.

8 Examination Records

8.1 Examination records will record the date and room number, if multiple rooms are available, that each individual item or group of items, if they were packaged together, are being processed. Tasks are completed on the date recorded unless otherwise noted.

8.2 An examiner will review the trace evidence processing notes prior to performing their examinations if the evidence was processed by an individual other than themselves. This review will be recorded in the Case Record Communication Log for FA cases or on the *Case Activity and Communication Log* (7-245) for Legacy cases.

9 Evidence Transfers in TEU

9.1 When items of primary evidence are to be transferred prior to the completion of processing of all primary evidence items, excluding known hair samples, assigned to the case record, a note will be recorded by the Examiner or Physical Scientist in the Case Record Communication Log to record the decision to do so.

9.1.1 At the time that these items are returned, the individual processing the evidence will confirm that all necessary processing was completed on these items. This confirmation will be recorded in the Case Record Communication Log.

9.1.2 With Technical Leader approval, this requirement may be waived due to the circumstances of the case. This waiver will be documented in the Case Record Communication Log.

10 References

- FBI Laboratory Quality Assurance Manual.
- FBI Laboratory Operations Manual.
- FBI Laboratory Safety Manual.
- Trace Evidence Procedures Manual.

Rev. #	Issue Date	History
6	10/02/2017	Changed title and throughout from Unit based to discipline based document. Added SBAU-Trace to Sections 1.1 and 2.2. Removed Sections 1.2, 1.3, 2, 3, 4, 5.3, 6, 7, 8, and 9 and renumbered. Information is in other documents. Reworded Sections 2.1, 2.1.1, 2.1.3, 2.1.4 for clarity between Legacy and FA cases. Added Sections 2.5 and 2.6 for SBAU-Trace specific details. Added SBAU-Trace SEI forms as appendices.
7	02/03/2020	Updated SBAU-Trace name throughout. Removed reference to drug and valuable evidence handling in Scope. Updated Section 2.4.1 to allow for FA generated Secondary Evidence Log. Clarified Section 3 specific to Multi-unit submissions. Changed Section 4.4 title from 'Archived Collections' to 'Retained Secondary Evidence.' Updated wording in Sections 2.3, 4.1.4, all of 4.4, 7, and 8.2. Removed reference to 'search slip' for Legacy cases. Changed 'geological' to 'geologically-derived' throughout.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Appendix A: *Trace Evidence Unit Secondary Evidence Inventory* for Legacy cases

Redacted - Form on File

Appendix B: *SBAU-TRACE Legacy Secondary Evidence Inventory* Log

Redacted - Form on File

Appendix C: *Trace Evidence Unit Secondary Evidence Inventory* for FA cases

Redacted - Form on File

Appendix D: *SBAU-TRACE FA Secondary Evidence Inventory* Log

Redacted - Form on File

General Approach to Report Writing

1 Scope

This document provides a guideline for reporting results for examiners who issue reports in the Trace Evidence Unit and Scientific and Biometrics Analysis Unit – Trace.

2 Procedures

2.1 It will not always be possible to adequately summarize analytical findings using only the examples provided here. It is acceptable to use other wording when the following conditions are met:

- the results of the examinations are accurately communicated,
- a description of the methodology used to reach the results is included,
- known limitations are addressed,
- the most current version of the applicable *FBI Approved Standards for Scientific Testimony and Report Language and Department of Justice Uniform Language for Testimony and Reports are* followed, and
- the wording is approved by a second examiner who is qualified in the category of testing during the technical review process.

2.2 The *Laboratory Report* will be prepared and formatted in accordance with requirements set forth in the FBI Laboratory Operations Manual (LOM) - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases* or the *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA).*

2.3 The report will include a description of the methods used in analysis. Examples of appropriate wording for the methods used are included in Appendix A. If no examinations were conducted, then no methods section is required.

2.4 The **Results of Examinations** section will be used to communicate the results of the trace evidence examinations. Examples of appropriate wording for the **Results of Examinations** section are included in Appendix B.

2.4.1 If applicable, interpretations/limitations will be included and will be used to communicate any known limitations of the results, and/or limitations of the testing based on the evidence received. This information can be included in the **Results of Examinations** section or can be a separate section. This material will include any interpretations that may aid the reader in understanding the significance of the **Results of Examinations**. Examples of appropriate wording for the interpretations/limitations are included in Appendix C. If no examinations were conducted, then no interpretations/limitations section is required.

2.5 At a minimum, the **Remarks** section will provide the information required by the LOM - *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records for Legacy Cases* or the *Practices for Preparing, Reviewing, and Issuing Laboratory Reports and Retaining Records in Forensic Advantage (FA).*

3 Alternate Reporting

At times it may be appropriate for alternate reporting methods other than an *FBI Laboratory Report* (7-2, 7-2 LIMS, 7-253, 7-253 LIMS) to be used for an initiative and/or intelligence matters. The approval of alternate reporting is recorded in an EC approved by the Quality Manager and the Lab Director.

3.1 Both a Laboratory Report and an alternate reporting method (*e.g.*, Technical Assessment) may be issued on the same items of evidence.

3.1.1 The alternate reporting will carry the following caveat: "This document contains information provided for intelligence purposes only and is not a final Laboratory Report. This document may not be used as a Laboratory Report in criminal proceedings."

3.2 Relevant case notes and supporting data for the results provided in the alternate reporting method will be maintained in the appropriate case record for FA cases or physical 1A for Legacy cases.

3.3 Alternate reporting will be technically and administratively reviewed.

4 References

- FBI Laboratory Operations Manual
- FBI Approved Standards for Scientific Testimony and Report Language for the Microscopic Examination of Hairs (current version)
- FBI Approved Standards for Scientific Testimony and Report Language for the Microscopic Examination of Fibers (current version)
- FBI Approved Standards for Scientific Testimony and Report Language for the Forensic Anthropology Discipline (current version)
- FBI Approved Standards for Scientific Testimony and Report Language for Forensic Geologically-derived Materials Examinations (current version)
- FBI Approved Standards for Scientific Testimony and Report Language for Forensic Glass Examinations (current version)

- Department of Justice Uniform Language for Testimony and Reports for the Forensic Textile Fiber Discipline (current version)

- Department of Justice Uniform Language for Testimony and Reports for the Forensic Hair Discipline (current version)

- Department of Justice Uniform Language for Testimony and Reports for the Forensic Anthropology Discipline (current version)

- Department of Justice Uniform Language for Testimony and Reports for the Forensic Geology Discipline (current version)

- Department of Justice Uniform Language for Testimony and Reports for the Forensic Glass Discipline (current version)

Rev. #	Issue Date	History
3	01/31/2019	"Geologic Materials" changed to "Geologically-derived Materials" in Section 1 and 4, Appendices A, B and C. Updated wording for glass and geologically-derived materials in Appendices B and C to conform to The Department of Justice Uniform Language for Testimony and Reports requirements: headings added; "inconclusive" glass conclusion and "fracture fit" geologically-derived materials conclusion added to Appendix B; minor edits to wording of glass and geologically-derived materials conclusions; bullet list of conclusions in Appendix C for glass and geologically-derived materials completely revised; final paragraph of geologically derived material limitations in Appendix C added. Added the 'inconclusive' conclusion language for fiber examinations in Appendix B. Updated wording for Anthropology conclusions in Appendix C to conform to The Department of Justice Uniform Language for Testimony and Reports.
4	02/03/2020	Updated name of SBAU-Trace in Scope. Removed 'Introduction.' Added The Department of Justice Uniform Language for Testimony and Reports to Section 2.1 and to references. Updated Sections 3.3 and 3.4.1 regarding no exams being conducted. Added Section 3 on alternate reporting.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

Mineralogy Technical Leader: Date: 01/31/2020

Anthropology Technical Leader: Date: 01/31/2020

QA Approval

Redacted - Signatures on File

Quality Manager:

Date: 01/31/2020

Appendix A: *Examples of Appropriate Wording for the Methods used in a Trace Evidence Report*

Example of a hair examination and comparison:

Microscopic examination of hairs is accomplished by using stereomicroscopy and comparison microscopy. The presence or absence, appearance, arrangement and distribution of the characteristics within the cuticle, cortex, and medulla of the hairs are examined and may be compared during a hair examination.

Example of a fiber examination and comparison:

Microscopic examination of textile fibers is accomplished by using one or more analytical techniques including stereomicroscopy, comparison microscopy, polarized light microscopy, fluorescence microscopy, and instrumentally using microspectrophotometry and Fourier transform-infrared spectroscopy. The microscopic characteristics and optical properties determined by these techniques are used for the examination and comparison of fibers.

Example for a cordage examination and comparison (used in conjunction with fiber method):

Cordage examinations are accomplished through visual and microscopic examination of the cordage construction and the fibers comprising that cordage.

Example for a fabric examination and comparison (used in conjunction with fiber method):

Fabric examinations are accomplished through visual and microscopic examination of the fabric construction and the fibers comprising that fabric.

Example for a fabric physical match:

Physical matching of fabrics is accomplished through a visual examination of the damaged edges of two or more pieces of fabric. Damaged edges are characterized and compared macroscopically and using a stereomicroscope to determine if the pieces of fabric were previously one continuous item.

Example for a cordage physical match:

Physical matching of cordage is accomplished through a visual examination of the damaged edges of two or more pieces of cordage. Damaged edges are characterized and compared macroscopically and using a stereomicroscope to determine if the pieces of cordage were previously one continuous item.

Example of a glass examination and comparison:

Comparison of glass items for the purposes of determining the possibility of a common origin is accomplished by using one or more analytical techniques. These techniques include:

- Examinations of fracture surfaces for fractography are conducted using stereobinocular and/or compound microscopes.
- Determination of physical properties such as glass type, glass color, and thickness. The physical properties of the glass are determined using stereobinocular and petrographic microscopes, micrometers, and ultraviolet lights.
- Measurement of the refractive index at up to three wavelengths, 488 nm, 589 nm, and 656 nm. Refractive index of the glass is measured using the Foster + Freeman, Ltd. Glass Refractive Index Measuring system (GRIM3).
- Determination of the concentrations of aluminum, barium, calcium, iron, magnesium, manganese, sodium, strontium, titanium, and zirconium. The elemental concentrations are determined using a ThermoFisher iCAP 6500 Duo inductively coupled plasma - optical emission spectrometer (ICP-OES).

The actual tests performed are dependent on the size and shape of the glass fragments, and analytical requirements. When a difference is found between compared items, the examination may be immediately discontinued. For this case, a fractography examination was conducted between glass recovered from the debris from the cottage wall east (Item 1) and the windshield of the Formula Powerboat (Item 5).

Additionally, a comparative glass examination was conducted between the glass recovered from the vicinity of the cottage (Item 2 through Item 4) and the glass from the windshield of the Formula Powerboat (Item 5). The physical properties expressed in the glass were determined using stereobinocular and petrographic microscopes. Multiple measurements of refractive index at 589 nm wavelength and of the concentrations of the ten above listed elements were acquired.

Example of a geologically-derived materials examination and comparison:

Comparison of geologically-derived materials for the purposes of determining the possibility of a common origin is accomplished by using one or more analytical techniques. These techniques can include:

- Color designation: Determination of the color of the material. This may be accomplished unaided, or by using Munsell Soil Color Charts in a light box under day light conditions.
- Textural analysis: Determination of texture using stereobinocular and petrographic microscopes.
- Composition determination: Identification of components present and their relative proportions using stereobinocular and petrographic microscopes or additional instrumental methods, as needed.

The actual tests performed are dependent on the type(s) and quantity of the geologically-derived material present, and the needs of the examination/analytical requirements. When a difference is found between compared items, the examination may be immediately discontinued.

In this case, the items were examined for color using a using a light box and Munsell Soil Color Charts, and for texture and composition using stereobinocular and petrographic microscopes.

Example of an anthropology examination:

The techniques used for anthropological analyses typically include visual (morphoscopic) examination, metric analysis (*i.e.*, measuring bones and performing calculations), microscopic examination, or radiologic examination. The actual tests performed are dependent on the quality and quantity of skeletal material present, and the needs of the examination or analytical requirements.

In this case, the items were examined visually, microscopically, metrically, and radiologically.

Appendix B: *Examples of Appropriate Wording for the Results of Examinations Section of a Trace Evidence Report*

Example of a hair examination and comparison:

Inclusion:

A head hair that exhibits characteristics of European ancestry recovered from Item 1 is microscopically consistent with hairs in the head hair sample from {Name} (Item 5). Accordingly, based on the Item 5 head hair sample, {Name} can be included as a possible source of this hair. This hair has been designated as Item 1-1 for possible mitochondrial DNA analysis.

The comparison of microscopic characteristics in hairs does not constitute a basis for personal identification. The inclusion of an individual as a possible source of a hair based on microscopic characteristics should be evaluated in conjunction with the results of DNA analysis of the hair when available.

Inconclusive:

Similarities and Differences
A head hair that exhibits characteristics predominantly of European ancestry recovered from Item 2 exhibits both similarities and differences to hairs in the head hair sample from {Name} (Item 5). Accordingly, based on the Item 5 head hair sample, no conclusion can be reached as to whether or not {Name} can be included as a possible source of this hair. This hair has been designated as Item 2-1 for possible mitochondrial DNA analysis.

Similar but limited
A head hair that exhibits characteristics of African ancestry and is of limited value for microscopic comparison purposes was recovered from Item 3. This hair is microscopically similar to hairs in the head hair sample from {Name} (Item 5). However, due to the limited nature of this hair, no conclusion can be reached as to whether or not {Name} can be included as a possible source. This hair has been designated as Item 3-1 for possible mitochondrial DNA analysis.

Exclusion:

Head hairs that exhibit characteristics of Asian or Native American ancestry recovered from Item 4 are microscopically dissimilar to hairs in the head hair samples from {Name} (Item 5) and {victim Name} (Item 6). Accordingly, based on the Items 5 and 6 head hair samples, {Name} and {victim Name} cannot be included as possible sources of these hairs.

Examples of a fiber examination and comparison:

Inclusion:

Three green polyester fibers found on Item 3 exhibit the same microscopic characteristics and optical properties as the fibers comprising Item 1. Accordingly, these fibers are consistent with originating from the Item 1 shirt, or another source comprised of fibers that exhibit the same microscopic characteristics and optical properties.

No other apparent transfer of textile fibers was detected between Items 1 and 2 and Items 3 and 4.

OR

Green polyester fibers recovered from under the tape in Item 1 exhibit the same microscopic characteristics and optical properties as the green polyester fibers recovered from under the tape in Item 2. Accordingly, these fibers are consistent with originating from the same source, or different sources comprised of fibers that exhibit the same microscopic characteristics and optical properties.

Inconclusive:

Three fibers recovered from Item 2 and the fibers comprising Item 3 do not exhibit sufficient observable microscopic characteristics or optical properties to perform a full fiber examination and comparison. Accordingly, no conclusion can be reached as to whether or not these fibers are consistent with originating from the same source.

Example for a fabric examination and comparison:

Inclusion:

The black fabric in Item 1 exhibits the same color, construction, and composition as the black fabric in Item 2. Accordingly, the piece of black fabric in Items 1 and 2 are consistent with originating from the same source or from two sources with the same color, construction, and composition.

Example for a cordage examination and comparison:

Inclusion:

The brown thread in Item 3 exhibits the same color, construction, and composition as the brown thread in Item 1. Accordingly, the lengths of brown thread in Items 1 and 3 are consistent with originating from the same source or from two sources with the same color, construction, and composition.

Example for a fabric physical match:

Inclusion:

The pieces of fabric in Item 1 and Item 2 physically match together. Accordingly, the pieces of fabric were once one contiguous piece of fabric.

Example for a cordage physical match:

Inclusion:

The pieces of rope in Item 1 and Item 2 physically match together. Accordingly, the pieces of rope were once one contiguous piece of rope.

Example of a glass examination and comparison:

Fracture Fit:

Item 1 physically fits together with a piece of glass from the windshield of the Formula Powerboat (Item 5). Consequently, the piece of glass recovered from the debris from the cottage wall east (Item 1) was once part of the windshield of the Formula Powerboat (Item 5) (a fracture fit, see interpretation section, below).

Inclusion:

Glass recovered from the vicinity of the cottage (Item 2) is indistinguishable from glass from the windshield of the Formula Powerboat (Item 5). Consequently, the glass from the vicinity of the cottage (Item 2) either originated from the windshield of the Formula Powerboat (Item 5) or from another source of broken glass indistinguishable in all of the measured or observed physical properties, refractive index, and elemental composition (an inclusion, see interpretation section, below).

Inconclusive:

Debris recovered from the vicinity of the cottage (Item 3) contains glass fragments that are too small for analysis. No conclusions can be reached as to whether or not these glass fragments could have originated from the windshield of the Formula Powerboat (Item 5) (inconclusive, see interpretation section, below).

Exclusion:

Glass recovered from under the rear of the cottage (Item 4) is compositionally different than the glass from the windshield of the Formula Powerboat (Item 5). Consequently, the glass recovered from under the rear of the cottage (Item 4) did not originate from the windshield of the Formula Powerboat as represented by Item 5 (an exclusion, see interpretation section, below).

Example of a soil examination and comparison:

A soil comparison was conducted between soil recovered from the shoes (Items 1 through 4), and the soil from various locations (Item 7 and Item 8), and between debris recovered at the grave site (Item 5) and a brick from the residence (Item 6).

Fracture Fit:

The debris recovered from the grave site and the brick from the residence (Items 5 and 6, respectively) are each broken pieces of a brick. The brick piece recovered from the grave site (Item 5) physically fits together with the broken brick from the residence (Item 6). Consequently, the brick piece recovered from the grave site (Item 5) was once part of the brick from the residence (Item 6) (a fracture fit, see interpretation section, below).

Inclusion:
Soil recovered from the debris from the shoes (Items 1 and 2) cannot be differentiated from the soil from the dirt road in front of the residence as represented by Item 8 by color, texture, and composition comparison. Consequently, the dirt road in front of the residence as represented by Item 8 cannot be eliminated as a possible source of the soil from the debris from the shoes (Items 1 and 2) (an inclusion, see interpretation section, below).

Exclusion:

Soil recovered from the debris from the shoes (Items 1 and 2) is different than the soil recovered from the grave site as represented by Item 7. Therefore, the grave site as represented by Item 7 is eliminated as a source of the soil on the shoes (Items 1 and 2) (an exclusion, see interpretation section, below).

Inconclusive

Debris recovered from the slippers (Items 3 and 4) contains insufficient geologic material for comparison to the grave site (Item 7) and dirt road (Item 8). No conclusion can be reached as to whether or not the debris recovered from the slippers (Items 3 and 4) originated from the grave site or dirt road (Items 7 and 8, respectively) (inconclusive, see interpretation section, below).

Example of an anthropology examination:

Inventory/Bone Identification

Items 9 and 10 are bones of non-human in origin, and no further anthropological examinations were conducted on those items.

Item 11 consists of images reported to originate from Jane Johnson.

Items 1 through 8 are bones of human origin and are identified below by element and side (where applicable):

Item 1 Cranium
Item 2 Mandible (lower jaw bone)
Item 3 Femur (upper leg bone), right
Item 4 Tibia (lower leg bone), right
Item 5 Scapula (shoulder blade), right
Item 6 Os coxa (hip bone), left
Item 7 Os coxa (hip bone), right
Item 8 Clavicle (collar bone), left

Biological Profile

The following biological parameters were estimated from the human skeletal remains:

Sex:	Female
Ancestry:	European
Age:	23-27 years
Stature:	63-67 inches (95 prediction interval)

The estimate of female sex was based on the female morphology of Item 6 and Item7 (including wide sciatic notches, a large subpubic angle, and the presence of a preauricular sulcus), small femoral head diameter of Item 3 (43mm), and overall small size and small muscle attachments of Items 1 through 8. European ancestry was estimated based on cranial measurements analyzed using FORDISC 3.0 comparing it to females of several ancestries. When compared to females of European, African American, and American Indian ancestry, FORDISC indicates a 0.90 posterior probability of European ancestry, while the posterior probabilities were much lower for being African (0.05), or American Indian (0.05). Skeletal maturation of Items 1 through 7 is complete, but Item 8 is in the final stages of epiphyseal union indicating an age of 23-27 years. Pubic symphyseal morphology of Items 6 and 7 also supports a relatively young age. Stature was estimated using FORDISC-assisted analysis of measurements of Item 3 and Item 4 using a European female reference.

Trauma

Bilateral perforations of the Item 1 cranium suggest alteration by a high velocity projectile such as a bullet. Radiographs of Item 1 were negative for radioopacities consistent with the presence of foreign material. The relative sizes of the perforations and the direction of beveling indicate projectile entry on the left side and exit on the right. The absence of bone remodeling (healing) as well as the nature and pattern of missing bone and associated fractures suggest that the trauma occurred perimortem (at or around the time of death). Perimortem timing of trauma is determined on the basis of evidence of the biomechanical characteristics of fresh bone regardless of the temporal relationship to the actual death event. No additional trauma was noted.

Identification Comparison

The biological information reported for Jane Johnson, a 26-year old, 5'4" white female, is consistent with the biological profile above (that is, the information on Jane Johnson falls within the range of the biological profile estimated from the skeletal remains). Anterior-posterior radiographs taken of Item 1 were compared to the images contained in Item 11. The quality and quantity of shared details of the radiographic images from the Item 1 cranium and the Item 11 images from Jane Johnson indicate that Jane Johnson can be included as the source of Item 1.

Appendix C: *Examples of Appropriate Wording for the Interpretations/Limitations Section of a Trace Evidence Report*

Example of a hair examination and comparison:

Hairs may be characterized and classified according to their morphology. The first step is determining whether the hair is of human or animal (non-human) origin. Animal hairs may be further classified as to the type of hair (*e.g.*, fur, guard) and the type of animal (*e.g.*, dog, cat). Human hairs may be further examined for characteristics of ancestry and somatic origin (body area). Human hairs can exhibit characteristics of European Ancestry (previously Caucasian), African Ancestry (previously Negroid), or Asian/Native American Ancestry (previously Mongoloid). Human hairs may also exhibit characteristics of more than one ancestral group. Ancestral group classifications are based on macroscopic and microscopic characteristics which are typically observed in hairs from individuals of different ancestral groups. It should be noted, there is the potential for a hair to be classified into an ancestral group which may not correspond with an individual's outward physical appearance and/or how an individual identifies their own race or ethnic group. Somatic origin classifications are based on the macroscopic and microscopic characteristics which are typically observed in hairs from different areas of the body.

The characteristics exhibited in the hair(s) are used as the comparison criteria. When the presence or absence, appearance, and distribution of characteristics exhibited in a recovered hair(s) are represented in the known sample, the source of the known sample can be included as a possible source of the recovered hair(s). Microscopic hair comparisons are meaningful due to the variation in macroscopic and microscopic characteristics between individuals. However, the comparison of hair characteristics does not constitute a basis for personal identification and the number of individuals who could be included as a possible source of a specific hair is unknown.

The inability to associate persons/items through a microscopic hair/fiber examination does not necessarily mean the persons/items of interest had no contact. A number of factors can produce this result, including: 1) Hair/fiber evidence may not have transferred. 2) Hairs/fibers that did transfer may have been lost prior to submission to the laboratory. 3) The hairs/fibers transferred or the known sample submitted may not be representative of the source. 4) The hairs/fibers may be from a different source.

Example of a fiber examination and comparison:

Fibers can differ as to type (*e.g.*, rayon, cotton), color, shape, size, microscopic features (*e.g.*, delustrant, voids) and optical properties (*e.g.*, refractive index, sign of elongation). These are characteristics that may associate fibers with a group of items, but never to a single item to the exclusion of all others. However, even fibers with many similar properties may be excluded as originating from the same source by using the identified analytical methods.

The characteristics and optical properties of the fiber(s) are used as comparison criteria. When the characteristics and optical properties of a recovered fiber(s) are the same as a known sample,

the recovered fibers are consistent with originating from the source of the known sample, or from another item comprised of fibers that exhibit the same microscopic characteristics and optical properties. A fiber association is not a means of positive identification and the number of possible sources for a specific fiber is unknown. However, due to the variability in manufacturing, dyeing, and consumer use, one would not expect to encounter a fiber selected at random to be consistent with a particular item.

The inability to associate persons/items through a microscopic hair/fiber examination does not necessarily mean the persons/items of interest had no contact. A number of factors can produce this result, including: 1) Hair/fiber evidence may not have transferred. 2) Hairs/fibers that did transfer may have been lost prior to submission to the laboratory. 3) The hairs/fibers transferred or the known sample submitted may not be representative of the source. 4) The hairs/fibers may be from a different source.

Example for a fabric examination and comparison (used in conjunction with fiber interpretation):

A fabric examination begins with the characterization of the construction (e.g., woven, knit, non-woven) and an analysis of the fibers comprising the fabric. When all of the characteristics present in a fabric sample (color, construction and composition) are the same as another fabric sample, the possibility that the compared fabrics originated from the same source cannot be excluded.

Example for a cordage examination and comparison (used in conjunction with fiber interpretation):

An examination of cordage begins with the characterization of the construction (*e.g.*, twisted, braided) and an analysis of the fibers comprising the cordage. When all of the characteristics present in a cordage sample (color, construction and composition) are the same as in a potential source, the possibility that the compared cordage originated from the same source cannot be excluded.

Example for a fabric physical match:

Examination of fabrics for physical fits begins with the characterization of the construction of the fabric and an analysis of the type of damage present (*e.g*., cut, torn). The shape, appearance, and yarns along the damaged edges are used as criteria for comparison. When two or more pieces of fabric can be oriented so the size, shape, and appearance of the damaged edges can be uniquely correlated, it can be determined that the two pieces were at one time one continuous piece.

Example for a cordage physical match:

An examination of cordage for physical fit begins with the characterization of the construction of the cordage and an analysis of the type of damage present (*e.g*., cut, torn). The shape, appearance, and yarns along the damaged edges are used as criteria for comparison. When two or more pieces of cordage can be oriented so the size, shape, and appearance of the damaged edges

can be uniquely correlated, it can be determined that the two pieces were at one time one continuous piece.

Example of a glass examination and comparison:

If items do not physically fit together, they are compared based on their observed and measured properties. The possibility of a common origin is eliminated when any of the following criteria are met:

- The observed physical properties are different.
- The thickness of the recovered glass fragment falls outside the range of values measured in the exemplar glass.
- The average refractive index for a recovered glass fragment falls outside the range of values measured in the exemplar glass. This comparison is performed separately for each wavelength measured.
- The average concentration of each element for a recovered glass falls outside a modified 4σ confidence interval for the exemplar glass. A modified 4σ confidence interval is calculated by taking either the measured relative standard deviation for the concentration of each element in the exemplar or 3% of the average elemental concentration of each element measured in the exemplar, whichever is greater, and multiplying it by four. The confidence interval for each element is the average value of the elemental concentrations ± the modified 4σ. This comparison is performed separately for each elemental concentration measured.

When the physical properties assessed are not different, the average refractive index measurement of the recovered glass falls within in the range of the refractive index values of the exemplar glass, and the averages of the concentrations of all of the elements measured in the recovered glass falls within the modified 4σ interval of the exemplar glass, the glasses are said to be indistinguishable.

The variations in the observed and measured properties within a glass object are typically smaller than the variations among objects. Studies have shown that refractive index measured at 589 nm and elemental composition of glass used in conjunction are highly discriminating[1], differentiating most glass that is not the actual source. This finding strongly supports the supposition that a recovered glass fragment and a broken object with indistinguishable refractive index at 589 nm and elemental composition are unlikely to be from another source. While this finding is not a direct indicator of the rarity of a particular glass in any specific case, it can be used to show that the occurrence of coincidentally indistinguishable glass is rare. In glass items where only refractive index data can be measured, the chance of finding coincidentally indistinguishable glass is significantly higher.

[1]Koons, R. D. and Buscaglia, J. The forensic significance of glass composition and refractive index measurements, *Journal of Forensic Sciences* (1999) 44:496–503.

There are four possible conclusions when comparing glass fragments:

- Fracture Fit: The glass fragments were once part of the same broken object. This conclusion is an examiner's decision that two or more glass fragments show sufficient correspondence between their macro- and microscopic characteristics, providing extremely strong support for the proposition that they were once part of the same object; and insufficient disagreement between their macro-and microscopic characteristics, providing extremely weak support for the proposition that the glass fragments originated from different objects. This conclusion is reached when two or more pieces of broken glass physically fit together.

- Inclusion: The glass fragments either originated from the same broken glass source or from another source(s) of broken glass with indistinguishable characteristics. This conclusion may be reached with or without elemental composition.

  Inclusion with Elemental Composition Examination: If elemental composition data has been acquired, an examiner may conclude that two or more glass fragments either originated from the same broken glass source or from another source that is indistinguishable in all assessed physical characteristics, refractive index, and elemental composition. Such conclusions may include probabilities based on appropriate databases or documented frequencies.

  Inclusion with No Elemental Composition Examination: If elemental composition data has not been acquired, an examiner may conclude that two or more glass fragments either originated from the same broken glass source or from another source that is indistinguishable in all assessed physical characteristics and refractive index. Such conclusions may include probabilities based on appropriate databases or documented frequencies.

- Exclusion: The glass fragments are eliminated as originating from the same source(s). This conclusion is reached when two or more fragments of glass are different in their physical properties, refractive indices, or elemental concentrations.

- Inconclusive: The possible source(s) of broken glass cannot be determined. This conclusion is reached when the glass fragment is too limited in size or quality.

For additional information on forensic glass analysis and results interpretation, please see Almirall, Jose, and Tatiana Trejos, "Analysis of glass evidence," *Forensic Chemistry: Fundamentals and Applications* (2015): 228-272.

Limitations:

A forensic glass analysis is typically a comparison of two or more glass fragments in an attempt to determine if they originated from different sources. These analyses require the determination of class characteristics that may associate objects with a group of similar objects such as

containers, but never to a single object except in the case of a fracture fit. It is important to note, however, that although there may be several objects with identical properties, glass fragments can originate only from broken and not intact objects. Only when two or more broken glass fragments physically fit together can it be said that they were once part of the same object.

Example of a geologically-derived material examination and comparison:

Color, texture, and composition are used as comparison criteria when a sufficient quantity of soil for reliable and reproducible results is present. There are four possible conclusions when comparing geologically-derived material:

- Fracture Fit: The geologically-derived materials were once part of the same broken object. This conclusion can only be reached when two or more geologically derived materials physically fit together.
- Inclusion: The possibility that the geologically-derived (s) originated from the same source as the geologically-derived material collected from a known location (exemplar) cannot be eliminated. Additional geologically-derived material(s) that are indistinguishable in all assessed characteristics could also be potential sources. This conclusion is reached when the material(s) cannot be differentiated from the exemplar using all observed or measured characteristics, there is sufficient quantity of material for reliable and reproducible results, and no inseparable mixing or deleterious change is indicated.
- Inconclusive: No conclusion can be reached on whether or not the soils could have originated from the same source. This conclusion can be reached for several reasons, including insufficient quantity for either the soil item or exemplar, when there is inseparable mixing with other sources of geologic materials, or when there has been deleterious change of the item(s) or exemplar.
- Exclusion: The possibility that the item(s) originated from the same source as the exemplar is eliminated. This conclusion is reached when the item(s) can be differentiated from the exemplar, there is sufficient quantity of material for reliable and reproducible results, and no inseparable mixing or deleterious change is indicated.

Soil properties vary both across the land and below the land surface as a function of parent material, climate, biological activity, geography, and time, yielding soil which is distinct from location to location and with depth below the surface. These changes can occur abruptly or gradually. Therefore, the exemplar soils from a specific site must be interpreted to represent only that site, and may not be representative of all soils in the area or soil that may have been present in the past.

Limitations:

Due to the possible variations in soil, the boundaries of a homogeneous soil cannot be predicted with absolute certainty. Soil and geologic studies and maps of an area may assist in defining the approximate extent of a homogeneous soil.

When debris from an item is eliminated as originating from an exemplar location through a soil comparison, no inference can be made as to whether or not the item was present at that location. A number of factors can produce this results, including:

- The material did not originate from the location in question.

- No material was transferred from the location to the item.
- Material which may have transferred from the location to the item was not preserved.
- Additional material may have transferred at some other time which mixed into the material on the item(s).
- The exemplars from the location in question so not adequately represent that location.

A geologically-derived materials analysis is typically a comparison of two or more geologically-derived materials in an attempt to determine if they originated from different sources. These analyses require the determination of class characteristics that may associate objects within a group of similar objects such as a particular variety of wallboard from a specific manufacturer, but never to a single object except for a fracture fit. Only when two or more broken fragments of geologically-derived materials physically fit together can it be said that they were once part of the same object.

Example of an anthropology examination:

Limitations:

The conclusions that can be reached from anthropological examination of skeletal remains are dependent on the condition and completeness of the skeletal material. Results based on fragmentary or poorly preserved material may be inconclusive.

From studies of known individuals, suites of traits as well as metric relationships are understood to characterize certain groups; however, due to variation within the human species due to both genetic and external factors (such as diet and lifestyle), no particular feature or measurement is considered diagnostic of membership in any one particular group. Due to differences in ancestral reporting standards, possible matches with individuals of ancestries other than those reported should not be excluded without further investigation.

Studies of skeletal trauma have revealed patterns that show relationships with certain known causes and that are governed by bone biomechanical properties; however, due to the variety and complexity of factors that may contribute to disruption of skeletal tissues, it is not always possible to determine trauma mechanism or timing with certainty.

Identification comparisons involve assessment of the similarity of antemortem and postmortem skeletal information. The more distinctive or unusual the shared characteristics, or the greater the number of shared features, the more likely it is that the two originated from the same person. The strength of the correspondence may be reported based on reference to documented frequencies of particular skeletal conditions or features, if known. Identification comparisons may result in one of the following conclusions:

- *Inclusion*

‘Inclusion’ is an examiner’s conclusion that the questioned skeletal information could have originated from the same individual as the known skeletal information, or from another individual with the same skeletal features.
The basis for an ‘inclusion’ conclusion is an examiner’s decision that there is sufficient agreement between the features of the questioned and known skeletal information, with no unexplainable differences, to conclude that the skeletal information could have originated from the same individual or from another individual with the same skeletal features.
The strength of the agreement, based on relevant databases or published frequencies of shared skeletal feature(s), shall be reported, if known. If the frequency of the shared feature(s) is not known, the examiner shall disclose that the number of individuals who may also share the feature(s) is unknown.

- *Exclusion*

‘Exclusion’ is an examiner’s conclusion that the questioned and known skeletal information could not have originated from the same individual.
The basis for an ‘exclusion’ conclusion is an examiner’s decision that the questioned and known skeletal information exhibit sufficient differences in skeletal features such

that the questioned skeletal information could not have originated from the same individual as the known skeletal information.

- *Inconclusive*

‘Inconclusive’ is an examiner’s conclusion that no determination can be reached as to whether the questioned and known skeletal information could have originated from the same individual.
The basis for an ‘inconclusive’ conclusion is an examiner’s decision that there is insufficient quantity and/or quality of skeletal features in the known and/or questioned skeletal information to determine whether the skeletal information could have originated from the same individual or from another individual with the same skeletal features.

Performance Monitoring Protocol for FT-IR Systems

1 Scope

This document addresses the quality assurance/quality control (QA/QC) performance monitoring of the Fourier Transform Infrared (FT-IR) spectrometer systems utilized by personnel in the Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace). Identification of generic polymeric group and classification of polymeric sub-group is conducted using the FT-IR system(s) identified below or an equivalent or better system. The performance of the system(s) must be monitored in order to verify that the instrument is producing reliable and reproducible results.

2 Equipment/Materials/Reagents

- Fourier Transform Infrared (FT- IR) Spectrometer with Microscope Accessory: Thermo Nicolet 6700 or Nicolet is50 with Continuμm microscope accessory, or equivalent or better system
- Liquid nitrogen
- Dewar flask
- Polystyrene standard: 1.5mil (38 micron) matte-finish film mounted on a card (Traceable and/or non-traceable. See Section 3.1)
- Standards wheel in Nicolet 6700 or Nicolet is50 spectrometer bench: 1.5mil (38 micron) matte-finish NIST traceable polystyrene standard and 1.0mil Schott NG11, National Physical Laboratory (NPL) traceable optical glass reference installed within the bench
- Pinhole slide: Slide containing a metal disk with a 100 micron pinhole, an open hole approximately 11mm in diameter, and a 14mm diameter gold mirror (for Continuμm microscopes)

3 Standards and Controls

3.1 Daily Performance Standard

A 1.5mil polystyrene standard is analyzed as the performance standard to assess operating performance, wavenumber assignment, and continued integrity of the system. This analysis must be conducted each day the instrument is to be used before beginning casework analysis. The polystyrene standard used for this procedure requires no preparation. It is recommended by Thermo Scientific that the standard be replaced if showing signs of wear or if analysis of the standard does not produce the expected results. Newly acquired polystyrene standards that are accompanied by a statement of traceability to a NIST sample require no further testing before use. Non-serialized polystyrene standards that are not accompanied by a statement of traceability to a NIST sample require a comparative analysis with a traceable polystyrene

standard. This can be accomplished by comparison of spectral data to a spectrum obtained from a traceable, serialized polystyrene standard. The newly acquired polystyrene standard must also meet the Decision Criteria outlined in Section 5.3. If the newly acquired standard meets the aforementioned requirements, it can be used as a daily performance standard. If it does not meet the requirements, it will not be used as a daily performance standard. Spectral data produced during the acceptance process will be printed and stored within the TEU or SBAU-Trace FT-IR binder for the instrument it will be utilized with.

3.2 Performance Standards for Troubleshooting

The polystyrene standards on the standards wheel installed in the bench are analyzed during the Val-Q/ValPro quality assurance/quality control evaluations to verify that the components within the bench are performing as expected. (See Section 2)

The 1.5mil polystyrene standard that is used as the daily performance standard is also used to evaluate the Continuμm microscope accessory as needed during troubleshooting.

The standards used for this procedure require no preparation. It is recommended that they be replaced if showing signs of wear or if analysis of the standards does not produce the expected results.

4 Sampling

Not applicable.

5 Procedures

5.1 Daily Performance Check

The following steps are to be performed each day the instrument is to be used before beginning casework analysis. The appropriate information will be recorded in the instrument logbook.

a. Cool the detector by filling the internal Dewar with liquid nitrogen.

b. Load the appropriate microscope transmission method, and verify the following parameters:

- Mode = Transmission
- Number of scans = 128
- Resolution = 4
- Scan range = 650-4000cm^{-1} (wavenumbers)

c. Collect a sample spectrum of the 1.5mil polystyrene standard followed by a background spectrum of air (empty stage).

d. Use "Find Peaks" to label the major peaks. Evaluate the results using the Decision Criteria tabulated in Section 5.3.

e. Save the spectrum of the polystyrene standard in the appropriate electronic folder.

f. If the results are acceptable, the instrument may be used for casework. If the results are not acceptable, the polystyrene standard will be re-analyzed. If the results are still not acceptable, an out-of-service sign will be placed on the instrument, the appropriate log entry made, and the Technical Leader (TL) or SBAU - Instrumentation Operations group, contacted. The TL or SBAU - Instrumentation Operations group, will be responsible for ensuring the instrument is brought back into service. Any adjustments made will be recorded in the appropriate logbook.

g. The results of the polystyrene spectral analysis are acceptable if the following four peaks are within +/- 4 cm^{-1} of the expected values (ASTM 1421-99 (2015)). Passing results will be recorded in the instrument logbook, when appropriate. If the peak values are not within the acceptable range, see section 5.2 for troubleshooting.

Expected Value (cm^{-1})	Acceptable Range (cm^{-1})
3025	3021 to 3029
1601	1597 to 1605
1028	1024 to 1032
906	902 to 910

5.2 FT-IR Bench and/or Microscope Accessory Troubleshooting

The following evaluations may be performed as needed based on system performance. The following evaluations can help to troubleshoot poor instrument performance or malfunction. Evaluation results will be recorded in the affected instrument's logbook when appropriate.

5.2.1 Evaluation of the Bench Interferogram Signal

a. Load the "Transmission ESP" method.

b. On the "Bench" tab of "Experiment Setup", monitor the interferogram signal under a gain of one (1.0).

c. Record the peak-to-peak voltage of the interferogram in the instrument logbook. This value reflects the voltage being detected.

d. If the signal value has dropped significantly from the previous evaluation, the beamsplitter can be automatically adjusted to improve the beam voltage throughput. Refer to the manufacturer's instrument manuals for further instructions.

5.2.2 Evaluation of the FT-IR Microscope Accessory Interferogram Signal

a. Cool the detector with liquid nitrogen.

b. Load the microscope transmission method.

c. Set the objective and stage compensators to zero.

d. Align and focus the microscope using the 100 micron pinhole slide.

e. Monitor the interferogram signal under a gain setting of 1.0 on the Continuμm.

f. Record the peak-to-peak voltage of the interferogram in the instrument logbook.

5.2.3 Bench Evaluation

a. Initiate the appropriate system validation/qualification program (Val-Q/ValPro) from within the instruments software (Omnic or equivalent program). Run the Val-Q/ValPro validation to evaluate the performance of the bench. The pre-programmed software will automatically initiate the use of the internal standards which are installed within the bench of Thermo Scientific brand FT-IRs. (See Section 2)

b. Evaluate the validation report. The results of each test will be listed as pass/fail. If any tests fail, follow the prompts within the software for bench alignment, then conduct a second evaluation with Val-Q/ValPro. If the results are acceptable, save the report in the appropriate electronic file. Print a copy of the report and place it in the appropriate binder

b. If the results are still not acceptable, place an out-of-service sign on the instrument, make the appropriate log entry, and contact the TL or SBAU - Instrumentation Operations group. The TL or SBAU - Instrumentation Operations group is responsible for ensuring the instrument is brought back into service. Any adjustments made will be recorded in the appropriate logbook.

5.2.4 Continuμm Microscope Evaluation

See Section 5.1.

6 Calculations

Not applicable.

7 Measurement Uncertainty

Not applicable.

8 Limitations

Only properly trained personnel will perform the duties involved in the operation, maintenance, and/or troubleshooting of this instrument.

9 Safety

Standard precautions for the handling of liquid nitrogen to include lab coat, goggles, and cryogenic gloves will be taken. Personal protective equipment (at a minimum, a laboratory coat and gloves) will be used when handling any chemical. Refer to the FBI Laboratory Safety Manual for the proper handling and disposal of all chemicals. No specific hazards are associated with the microscopy techniques performed. Universal precautions will be followed.

10 References

- ASTM 1421-99 (2015), Standard Practice for Describing and Measuring Performance of Fourier Transform Mid-Infrared (FT-MIR) Spectrometers: Level Zero and Level One Tests, American Society for Testing and Materials, West Conshohocken, PA.
- FBI Laboratory Safety Manual
- FBI Laboratory Chemistry Unit Instrument Operation & Support *Performance Monitoring Protocol (QA/QC) for the Nicolet FTIRs*
- Thermo Scientific, Nicolet™ FT-IR User's Guide, Thermo Electron Corporation, Madison, WI: 2004 (P/N 269-155800, Received with Nicolet™ 6700)

- Thermo Scientific, Nicolet™ Continuμm™ Microscope User's Guide, Thermo Electron Corporation, Madison WI: 2006 (P/N 269-091804, Received with Nicolet™ 6700)

- Thermo Scientific, Nicolet™ is50 FT-IR Spectrometer User's Guide, Thermo Electron Corporation, Madison, WI: 2013-2014. Installed on is50 associated computer.

- Thermo Scientific, Nicolet™ Continuμm™ Infrared Microscope User's Guide, Thermo Electron Corporation, Madison WI: 2007-2014. Installed on is50 associated computer.

Rev. #	Issue Date	History
4	10/02/2017	Changed title to discipline/non-unit specific Section 1 - Added language denoting that protocol will be used by both TEU and SAU - Trace. Section 2 - Added Nicolet is50 instrument to list, Removed reference to Nicolet 670 bench. Section 3.1 - Added reference to SAU-Trace binder, changed to binder with instrument. Sections 5.1/5.2.3/5.3 - Added contacting SAU - Instrumentation Operations group if instrument is not within parameters and needs to be taken out of service. Section 10 - Updated references.
5	02/03/2020	Updated SBAU-Trace group name throughout. Updated in Section 5.1 e. Rearranged Decision Criteria to 5.1 g. Changed all reference to TEU Property Manager to TL.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

Performance Monitoring Protocol for Microspectrophotometers

1 Scope

This document addresses the quality assurance/quality control (QA/QC) performance monitoring of the microspectrophotometer (MSP) systems utilized by personnel in the Trace Evidence Unit (TEU) and Scientific and Biometrics Analysis Unit - Trace (SBAU-Trace). Color measurement of fibers is conducted using one of the MSP systems identified below or an equivalent or better system. The performance of the system must be monitored in order to verify that the instrument is producing reliable and reproducible results.

2 Equipment/Materials/Reagents

- Microspectrophotometer: CRAIC QDI 2010, CRAIC Microspectra 121™ (MSP 121)*, or equivalent or better system
- Calibration filters with certification of traceability to National Institute of Standards and Technology (NIST) standards:
  - Quartz slide marked with reference point
  - Holmium oxide standard
  - Didymium standard (if needed per manufacturer specifications)
  - Three neutral density standards: OD 0.1, OD 0.5, and OD 1.0
- Lens paper

3 Standards and Controls

The calibration filters are analyzed as the performance standard to assess operating performance, wavelength assignment, absorbance assignment, and continued integrity of the system. Calibration verification must be conducted each day the instrument is to be used before beginning casework analysis (See Section 4). The filters may only be used within the listed time frame on the certificate associated with the filter.

* The CRAIC Microspectra 121™ (MSP 121) is the designation that CRAIC gives to microspectrophotometers sold through GSA. Based on when the instrument was purchased it may designate differing models.

4 Procedure - Daily Performance Check

The following steps for calibration verification are to be performed each day the MSP system is used, before beginning casework analysis. The calibration verification spectra should be saved in the proper calibration folder in the MSP system.

a. Ignite the appropriate source and allow approximately 30 minutes of stabilization time before beginning analysis.

b. Place the quartz slide on the sample stage and obtain Köhler illumination. The slide will remain on the stage for the remainder of the analysis.

c. Initialize the calibration software feature in the system.

d. Begin the wavelength verification. Collect a spectrum of the holmium oxide standard.

e. Collect a spectrum of the didymium standard if required per manufacturer specifications

f. The software will compare the obtained values to the target values programmed for the holmium oxide and didymium filters (if needed) (example: 440.90nm ± 3.00nm). Verify that the software reports passing results and/or verify that the obtained values are within the target range as tabulated on the NIST traceability certificate.

g. If the obtained values are within the certified range, save the wavelength test results and document the results in the instrument log book.. Continue to the photometric calibration verification.

h. Begin the photometric verification. Collect a spectrum for each of the three (3) neutral density standards.

i. The software will compare the obtained values to the target values programmed for the assigned neutral density filters (example: 0.128 ± 0.026AU). Verify that the software reports passing results and/or verify that the obtained values are within the target range as tabulated on the NIST traceability certificate.

j. If the obtained values are within the certified range, save the photometric test results and document the results in the instrument log book. If passing results are obtained for both the wavelength and the photometric calibration verification tests, the MSP system is ready for use.

k. If at any point in the calibration verification process the obtained values are not within the certified range, verify Köhler illumination, gently clean the filters with lens paper, verify proper filter placement, and conduct a subsequent analysis. If the obtained values are still not within the certified range, place an out-of-service sign on the instrument, record the instrument status in the appropriate logbook, and contact the TEU Property Manager or SBAU-Trace supervisor, for assistance in troubleshooting. The TEU Property Manager or SBAU-Trace supervisor, is responsible for bringing the instrument back into service. Any adjustments made will be recorded in the appropriate logbook.

5 Limitations

Only properly trained personnel shall perform the duties involved in the operation, maintenance, and troubleshooting of this instrument.

6 Safety

Universal precautions will be followed. No specific hazards are associated with the microscopy techniques performed.

7 References

- QDI 2010 Microspectrophotometer User's Manual Version 3.2. 2002-2008 CRAIC Technologies, Inc.
- CRAIC Microspectra 121™ Microspectrophotometer Hardware User's Manual Version 5.0.3. 2002-2010 CRAIC Technologies, Inc.
- CRAIC Microspectra 121™ Microspectrophotometer Software User's Manual Version 3.1.2. 2002-2010 CRAIC Technologies, Inc.
- CRAIC Imaging Software User's Manual (MSP121) Version 3.0.4. 2002-2010 CRAIC Technologies, Inc.
- CRAIC Microspectra 121™ Microspectrophotometer Hardware User's Guide Version 2.5. 2002-2015 CRAIC Technologies, Inc.
- CRAIC LambdaFire™ Software User's Guide Version 2.6. 2002-2015 CRAIC Technologies, Inc.

Rev. #	Issue Date	History
3	10/02/2017	Changed title to discipline/non-unit specific. Removed Sections 3.1, 4, 6, and 7. Renumbered rest of sections. Section 1 - Added language denoting that protocol will be used by both TEU and SAU - Trace. Section 2 - Added footnote on MSP121 designation. Section 4 - Added that subfolders of spectra within an examiner's casework data folder may have identifying designation other than Laboratory number. Sections 4h, 4l - Added contacting SAU-Trace supervisor if instrument is not within parameters and needs to be troubleshot/taken out of service. Section 7 - Updated references.
4	02/03/2020	Removed Trace Evidence from the title. Updated SBAU-Trace name throughout. Updated instrument list in Section 2. Updated language in Sections 3 and 4.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/31/2020

Scientific and Biometrics Analysis Unit Chief: Date: 01/31/2020

Hairs and Fibers Technical Leader: Date: 01/31/2020

QA Approval

Quality Manager: Date: 01/31/2020

FBI Approved Standards for Scientific Testimony and Report Language For Forensic Anthropology

1 Purpose

This document provides examples of the scientifically-supported conclusions and opinions approved for reporting examination conclusions and offering expert opinion statements during testimony by Anthropology Examiners within the Trace Evidence Unit. It is noted that these examples are not intended to be all inclusive and may be dependent upon the precedent set by the judge or locality in which a testimony is provided. Further, these examples are not intended to serve as precedent for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous.

2 Scope

This document applies to Trace Evidence Unit employees who prepare an FBI *Laboratory Report* (7-1 or 7-1 LIMS) and/or provide testimony in the anthropology category of testing.

3 Statements Approved for FBI Anthropology Examination Testimony and/or Laboratory Reports

For additional guidance on report writing, see the *Trace Evidence General Approach to Report Writing*.

3.1 Osseous or Dental (Skeletal) Origin

The Examiner may assert that a material is *skeletal in origin, consistent with osseous or dental tissue*, or that a material may be *excluded as being skeletal (osseous or dental) in origin*. An Examiner may also state or imply that an *inconclusive* result is the determination that there is insufficient quality or quantity of material such that the Examiner is unable to determine the material's skeletal or non-skeletal origin.

3.2 Human or Non-human Origin

The Examiner may assert that skeletal material is *human in origin, consistent with human origin*, or

that a material may be *excluded as being human in origin*. An Examiner may also state or imply that an *inconclusive* result is the determination that there is insufficient quality or quantity of skeletal material such that the Examiner is unable to determine the material's human or nonhuman origin.

3.3 Biological Profile

3.3.1 Sex: The Examiner may assert that skeletal material likely originated from a male or female source. Such statements may include probabilities based on appropriate reference data.

3.3.2 Ancestry: The Examiner may assert that skeletal material likely originated from a particular ancestral group. Such statements may include probabilities based on appropriate reference data.

3.3.3 Age: The Examiner may assert that skeletal material likely originated from an individual within a certain biological age interval. Such statements may include probabilities based on appropriate reference data.

3.3.4 Stature: An Examiner may assert that skeletal material likely originated from an individual within a certain stature interval, which may include both a point estimate and the 95% prediction interval.

3.4 Identification Comparison

3.4.1 Inclusion (i.e., included)

3.4.1.1 'Inclusion' is an Examiner's conclusion that the questioned skeletal information could have originated from the same individual as the known skeletal information, or from another individual with the same skeletal features.

3.4.1.2 The basis for an 'inclusion' conclusion is an Examiner's decision that there is sufficient agreement between the features of the questioned and known skeletal information, with no unexplainable differences, to conclude that the skeletal information could have originated from the same individual or from another individual with the same skeletal features.

3.4.1.3 The strength of the agreement, based on relevant databases or published frequencies of shared skeletal feature(s), shall be reported, if known. If the frequency of the shared feature(s) is not known, the Examiner shall disclose that the number of individuals who may also share the feature(s) is unknown.

3.4.2 Exclusion (i.e., excluded)

3.4.2.1 'Exclusion' is an Examiner's conclusion that the questioned and known skeletal information could not have originated from the same individual.

3.4.2.2 The basis for an 'exclusion' conclusion is an Examiner's decision that the questioned and known skeletal information exhibit sufficient differences in skeletal features such that the questioned skeletal information could not have originated from the same individual as the known skeletal information.

3.4.3 Inconclusive

3.4.3.1 'Inconclusive' is an Examiner's conclusion that no determination can be reached as to whether the questioned and known skeletal information could have originated from the same individual.

3.4.3.2 The basis for an 'inconclusive' conclusion is an Examiner's decision that there is insufficient quantity and/or quality of skeletal features in the known and/or questioned skeletal information to determine whether the skeletal information could have originated from the same individual or from another individual with the same skeletal features.

3.5 Trauma Analysis

The Examiner may assert that a skeletal alteration occurred in the antemortem, perimortem, or postmortem period. The Examiner may state or imply that a skeletal alteration is consistent with originating from a blunt force, a sharp force, a high-velocity projectile, or thermal exposure.

4 Statements Not Approved For FBI Anthropology Examination Testimony and/or Laboratory Reports

4.1 Skeletal or Non-skeletal origin

When material is non-skeletal in origin, an Examiner shall not assert the origin of the material other than descriptive observations or, in certain cases, the elemental constituents of the material.

4.2 Human or Non-human origin

When skeletal material is non-human in origin, an Examiner shall not assert the non-human animal origin or species beyond general categories (e.g., mammal, bird).

4.3 Biological Profile

An Examiner shall not assert that skeletal material could not have originated from an individual with biological characteristics outside of the estimated parameters.

4.4 Identification Comparison

An Examiner shall not offer an 'inclusion' conclusion unless he or she explains that the skeletal information could also have originated from another individual who exhibits the same skeletal features.

4.5 Trauma Analysis

4.5.1 An Examiner shall not assert that a particular implement was the source of a skeletal alteration.

4.5.2 An Examiner shall not assert the cause or manner of death based on skeletal alterations and/or trauma.

4.6 Zero Error Rate

An Examiner shall not assert that forensic anthropological examinations are infallible or have a zero error rate.

4.7 Statistics or Probability

An Examiner shall not provide a conclusion that includes a statistic or numerical degree of probability except when based on relevant and appropriate data.

4.8 Experience

An Examiner shall not cite the number of forensic anthropological examinations performed in his or her career as a direct measure for the accuracy of a proffered conclusion. An Examiner may cite the number of forensic anthropological examinations performed in his or her career for the purpose of establishing,

defending, or describing his or her qualifications or experience.

4.9 Scientific Certainty

An Examiner shall not use the expressions 'reasonable degree of scientific certainty,' 'reasonable scientific certainty,' or similar assertions of reasonable certainty in reports or testimony unless required to do so by a judge or applicable law.

5 Laboratory Report Reviews

The content of a Trace Evidence Unit *Laboratory Report* will be reviewed per the appropriate LOM practices and the *Trace Evidence Casework Assignment and Review Procedures* to ensure compliance with the approved statements in this document.

6 Testimony Reviews

Anthropology testimonies will be reviewed following the *FBI Laboratory Practices for Testimony Related Activities*. This review will assess the testimony for compliance with the statements in this document.

7 References

ASCLD-LAB-*International* Supplemental Requirement for the Accreditation of Forensic Science Testing and Calibration Laboratories. American Society of Crime Laboratory Directors/Laboratory Accreditation Board, Garner, NC, 2011.

FBI Laboratory Quality Assurance Manual. Latest Revision.

FBI Laboratory Operations Manual. Latest Revision.

FBI Laboratory Trace Evidence Standard Operating Procedures. Latest Revision.

Department of Justice Uniform Language for Testimony and Reports for the Forensic Anthropology Discipline (current version)

Rev. #	Issue Date	History
1	10/20/2017	Changed title to discipline/non-unit specific. Changed *Report of Examination* to *Laboratory Report* throughout Section 2 changed discipline to category of testing. Section 3.3 and 3.4 changed designee to supervisor Section 4.4.1 revised for consistency with TEU Anthropology ASSTR Updated References
2	01/31/2019	Removed Trace Evidence from Title Removed Section 3 Responsibilities Updated language in 4.4 through 5.9 to be consistent with Department of Justice Uniform Language for Testimony and Reports for the Forensic Anthropology Discipline (current version) to include changing 'state or imply' to assert throughout

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/30/2019

Anthropology Technical Leader: Date: 01/30/2019

QA Approval

Quality Manager: Date: 01/30/2019

FBI Approved Standards for Scientific Testimony and Report Language For the Microscopic Examination of Hairs

1 Purpose

This document provides examples of the scientifically-supported conclusions and opinions approved for reporting examination conclusions and offering expert opinion statements during testimony by Hair Examiners within the Trace Evidence Unit and Scientific Analysis Unit - Trace. It is noted that these examples are not intended to be all inclusive and may be dependent upon the precedent set by the judge or locality in which a testimony is provided. Further, these examples are not intended to serve as precedent for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous.

2 Scope

This document applies to Hair Examiners within the Trace Evidence Unit and Scientific Analysis Unit - Trace who prepare *Laboratory Reports* (7-1, 7-1 LIMS, 7-273, or 7-273 LIMS) and/or provide testimony for microscopic hair examinations.

3 Statements Approved for FBI Trace Evidence Unit and Scientific Analysis Unit –Trace Examination Testimony and/or Laboratory Reports

For additional guidance on report writing, see the *General Approach to Report Writing* procedure.

3.1 Somatic Origin

The Examiner may assert that a human hair is classified as a head hair, pubic hair, facial hair, transitional hair, or body hair. An examiner may further assert that a body hair exhibits characteristics of a limb hair, axillary hair, chest hair, or eyebrow/eyelash hair. Body area classifications are based on the macroscopic and microscopic characteristics which are typically observed in hairs from different areas of the body.

3.2 Characteristics of Ancestry

The Examiner may assert that a human hair exhibits European Ancestry (formerly Caucasian), African Ancestry (formerly Negroid) and/or Asian or Native American Ancestry (formerly Mongoloid) characteristics. Ancestral group classifications are based on characteristics which are typically observed in hairs from individuals of different ancestral groups and may or may not correspond with how an individual identifies his or her race or ethnic group.

3.3 Animal Hair Classification

The Examiner may assert that a hair is an animal (non-human) hair consistent with a particular type of animal (*e.g.*, cat, dog, mink). Animal hair classifications are based on characteristics which are typically observed in hairs from different types of animals.

3.4 Growth Stage

The Examiner may assert that a hair exhibits characteristics of the anagen or telogen growth phase. Hairs in the anagen growth phase require some force to be removed from an individual; however, the amount of force required to remove a specific hair is unknown.

3.5 Damage

The Examiner may assert that a hair is consistent with having been cut, broken, crushed and/or burned; however, the specific source that caused the damage cannot be determined.

3.6 Artificial Treatment

The Examiner may assert that a hair has been artificially treated (*e.g.*, dyed or bleached) or that it exhibits characteristics of having been artificially treated.

3.7 Characteristics of Decomposition

The Examiner may assert that a hair exhibits characteristics of decomposition to include postmortem banding. These characteristics may be observed in hairs that have been removed from individuals postmortem; however, the possibility of other conditions causing the same or similar characteristics cannot be excluded.

3.8 Comparisons

3.8.1 Inclusion

3.8.1.1 Human Hair

The Examiner may assert that the questioned human hair is microscopically consistent with the known hair sample and accordingly, the source of the known hair sample can be included as a possible source of the questioned hair. Microscopic hair comparisons are meaningful due to the variation in macroscopic and microscopic characteristics between individuals. However, the comparison of hair characteristics does not constitute a basis for personal identification and the number of individuals who could be included as a possible source of a specific hair is unknown.

3.8.1.2 Animal Hair

The Examiner may assert that the questioned animal hair is microscopically consistent with the known animal hair sample and accordingly, the source of the known hair sample can be included as a possible source of the questioned hair. However, animal hairs do not typically possess sufficient differences in microscopic characteristics to distinguish between animals of similar breed and color.

3.8.2 Exclusion

The Examiner may assert that the questioned hair is microscopically dissimilar to the known hair sample. Accordingly, based on the known sample provided, the source of the known hair cannot be included as a possible source of the questioned hair.

3.8.3 Inconclusive

The Examiner may assert that no conclusion can be reached because the questioned hair exhibits both similarities and dissimilarities to the known sample or because the hair is of limited value for microscopic comparisons.

3.8.4 Suitability

The Examiner may assert that a hair is suitable, has limited suitability, or not suitable for meaningful microscopic comparison purposes.

4 Statements Not Approved For FBI Microscopic Hair Examination Testimony and/or Laboratory Reports

4.1 Individualization

The Examiner may not assert that a hair came from a particular source to the exclusion of all others.

4.2 Statistical Weight

The Examiner may not assert a statistical weight or probability to a conclusion or provide a likelihood that the questioned hair originated from a particular source.

4.3 Zero Error Rate

The Examiner may not assert that the method used in performing microscopic hair examinations has a zero error rate or is infallible.

4.4 Scientific Certainty

An Examiner shall not use the expressions ‘reasonable degree of scientific certainty,’ ‘reasonable scientific certainty,’ or similar assertions of reasonable certainty in reports or testimony unless required to do so by a judge or applicable law.

5 Laboratory Report Reviews

The content of a *Laboratory Report* will be reviewed per the appropriate FBI Laboratory Operations Manual (LOM) practices and *Trace Evidence Casework Assignment and Review Procedures* to ensure compliance with the approved statements in this document.

6 Testimony Reviews

Testimonies involving hair examinations and comparisons will be reviewed following the LOM - *Practices Testimony Related Activities*. The review will assess the testimony for compliance with the statements in this document.

7 References

- FBI Laboratory Quality Assurance Manual.
- FBI Laboratory Operations Manual.
- Trace Evidence Quality Manual, *Trace Evidence Casework Assignment and Review Procedures*.
- Trace Evidence Quality Manual, *General Approach to Report Writing.*
- Department of Justice Uniform Language for Testimony and Reports for the Forensic Hair Discipline (current version).

Rev. #	Issue Date:	History:
3	06/20/2018	Removed 'Trace Evidence' from title. Section 4.1 – Modified classification of transitional hair. Section 4.2 – Changed ancestral groups to European, African, and Asian or Native American. Section 4.8.4 – Added limited suitability
4	01/31/2019	Changed 'state or imply' to 'assert' throughout document for consistency with Department of Justice Uniform Language for Testimony and Reports for the Forensic Hair Discipline. Removed Section 3 'Responsibilities.' Added Section 4.4. Updated document title in Section 6.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/30/2019

Acting Scientific Analysis Unit Chief: Date: 01/30/2019

Hairs and Fibers Technical Leader: Date: 01/30/2019

QA Approval

Quality Manager: Date: 01/30/2019

FBI Approved Standards for Scientific Testimony and Report Language For the Forensic Examination of Fibers

1 Purpose

This document provides examples of the scientifically-supported conclusions and opinions approved for reporting examination conclusions and offering expert opinion statements during testimony by Fiber Examiners within the Trace Evidence Unit and Scientific Analysis Unit - Trace. It is noted that these examples are not intended to be all inclusive and may be dependent upon the precedent set by the judge or locality in which a testimony is provided. Further, these examples are not intended to serve as precedent for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous.

2 Scope

This document applies to Trace Evidence Unit and Scientific Analysis Unit - Trace employees who prepare a *Laboratory Report* (7-1, 7-1 LIMS, 7-273, or 7-273 LIMS) and/or provide testimony for textile fiber examinations.

3 Statements Approved for FBI Trace Evidence Unit and Scientific Analysis Unit - Trace Examination Testimony and/or Laboratory Reports

For additional guidance on report writing, see the *Trace Evidence General Approach to Report Writing* procedure.

3.1 Fiber Classification

The Examiner may assert that a textile fiber is natural or manufactured (man-made).

3.1.1 Natural Fibers

The Examiner may assert the type of natural fiber (e.g., cotton, wool, silk).

3.1.2 Manufactured Fibers

The Examiner may assert the type of manufactured fiber (e.g., polyester, nylon). The Examiner may further assert that the manufactured fiber is consistent with a particular sub-group (e.g., polyethylene terephthalate, nylon 6).

3.2 Comparisons

3.2.1 Inclusion

The Examiner may assert that the questioned fiber exhibits the same microscopic characteristics and optical properties as the known sample and accordingly, the questioned fiber is consistent with originating from the source of the known sample or from another item comprised of fibers that exhibit the same microscopic characteristics and optical properties.

The Examiner may also assert that two or more questioned fibers exhibit the same microscopic characteristics and optical properties and accordingly, are consistent with originating from the same item or from different items comprised of fibers that exhibit the same microscopic characteristics and optical properties.

A fiber association is not a means of positive identification and the number of possible sources for a specific fiber is unknown. However, due to the variability in manufacturing, dyeing, consumer use, and published studies, one would not expect to encounter a fiber selected at random to be consistent with a particular item.

3.2.2 Exclusion

The Examiner may assert that the questioned fiber is dissimilar to the known fiber sample and accordingly, is not consistent with originating from the source of the known sample. The Examiner may also assert that two or more questioned fibers are dissimilar and accordingly, not consistent with originating from the same item.

3.2.3 Inconclusive

The Examiner may assert that no conclusion can be reached because there are insufficient microscopic characteristics or optical properties to determine whether or not two or more fibers are consistent with originating from the same source.

4 Statements Not Approved For FBI Microscopic Fiber Examination Testimony and/or Laboratory Reports

4.1 Individualization

The Examiner may not assert that a fiber came from a particular source to the exclusion of all other sources.

4.2 Statistical Weight

The Examiner may not assert a statistical weight or probability to a conclusion or provide a likelihood that the questioned fiber originated from a particular source.

4.3 Zero Error Rate

The Examiner may not assert that the method used in performing fiber examinations has a zero error rate or is infallible.

4.4 Scientific Certainty

An Examiner shall not use the expressions ‘reasonable degree of scientific certainty,’ ‘reasonable scientific certainty,’ or similar assertions of reasonable certainty in reports or testimony unless required to do so by a judge or applicable law.

5 Laboratory Report Reviews

The content of a *Laboratory Report* will be reviewed per the appropriate FBI Laboratory Operations Manual (LOM) practices and the *Trace Evidence Casework Assignment and Review Procedures* to ensure compliance with the approved statements in this document.

6 Testimony Reviews

Testimonies involving fiber examinations and comparisons will be reviewed following the LOM - *Practices for Testimony Related Activities*. The review will assess the testimony for compliance with the statements in this document.

7 References

- FBI Laboratory Quality Assurance Manual.
- FBI Laboratory Operations Manual.
- Trace Evidence Quality Manual, *Trace Evidence Casework Assignment and Review Procedures*.
- Trace Evidence Quality Manual, *Trace Evidence General Approach to Report Writing*.
- Department of Justice Uniform Language for Testimony and Reports for the Forensic Textile Fiber Discipline (current version)

Rev. #	Issue Date	History
2	10/02/2017	Changed title to discipline/non-unit specific Section 1, 2, and 4 - Added language denoting that standard will be used by both TEU and SAU - Trace. Section 2 - Added TEDAC Laboratory Report form numbers. Sections 3.3 and 3.4 - Added SAU UC. Sections 4 and 6 - Changed references to discipline from unit protocols. Sections 4.2.1 and 4.2.2 - Updated to include verbiage applying to the comparison of two or more questioned fibers. Section 7 - Removed reference to specific unit testifying and added fiber examination and comparison. Section 8 - Updated references.
3	01/31/2019	Removed Trace Evidence from title. Removed Section 3 'Responsibilities' Section 4.2.3 – added inconclusive language to provide consistency with Department of Justice Uniform Language for Testimony and Reports for the Forensic Textile Fiber Discipline to include changing 'state or imply' to 'assert' throughout document. Added Section 4.4. Updated document title in Section 6.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief: Date: 01/30/2019

Acting Scientific Analysis Unit Chief: Date: 01/30/2019

Hairs and Fibers Technical Leader: Date: 01/30/2019

QA Approval

Quality Manager: Date: 01/30/2019

FBI Approved Standards for Scientific Testimony and Report Language For Forensic Geologically-derived Materials Examinations

1 Purpose

This document provides examples of scientifically-supported conclusions and opinions approved for reporting examination conclusions and offering expert opinion statements during testimony by Geologist/Forensic Examiners within the Mineralogy Group of the Trace Evidence Unit (TEU). These examples are not intended to be all inclusive. The actual statements that may be provided in a particular case may be subject to prior legal precedent in the locality in which a testimony is provided. Further, these examples are not intended to serve as requirements for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous. Explanations supporting the statements contained in this document can be found in the FBI Laboratory Quality Assurance Manual, FBI Laboratory Operations Manual, Trace Evidence Quality Assurance Manual, Trace Evidence Procedures Manual, and current reliable references

2 Scope

This document applies to Geologist/Forensic Examiners within the TEU Mineralogy Group who prepare FBI *Laboratory Reports* (7-1 or 7-1 LIMS) and/or provide testimony in the area of forensic geologic materials (e.g., soil, rocks, minerals, gemstones), or geologically-derived materials (e.g., bricks, concrete blocks, ceiling tile), and unknown materials of suspected geologic origin. For the purposes of this document, geologic materials, geologically-derived materials, and unknown materials of suspected geologic origin will be collectively referred to as "geologically-derived materials."

3 Statements Approved for FBI TEU Mineralogy Group Forensic Geology Comparisons Testimony and/or Laboratory Reports

For additional guidance on report writing, see the Trace Evidence General Approach to Report Writing.

3.1 Fracture Fit: An Examiner may assert that the geologically-derived materials were once part of the same broken object. This conclusion can only be reached when two or more geologically derived materials physically fit together and show sufficient correspondence between their macro- and microscopic characteristics to indicate they once comprised a single object, and insufficient disagreement between their macro-and microscopic characteristics to conclude that they originated from different objects.

3.2 Inclusion: An Examiner may assert that the possibility that the geologically-derived

material(s) originated from the same source as the known exemplar cannot be eliminated. Additional geologically-derived material(s) that are indistinguishable in all assessed characteristics could also be potential sources. This conclusion is reached when the material(s) cannot be differentiated from the exemplar using all observed or measured characteristics, there is sufficient quantity of material for reliable and reproducible results, and no inseparable mixing or deleterious change is indicated.

3.3 Inconclusive: An Examiner may assert that no determination can be reached as to whether or not the geologically-derived materials could have originated from the same source. This conclusion can be reached for several reasons, including insufficient quantity for either the material or the exemplar, when there is inseparable mixing with other sources of geologically-derived materials, or when there has been deleterious change of the item(s) or exemplar.

3.4 Exclusion: An Examiner may assert that the possibility that the geologically-derived material(s) originated from the same source as the exemplar is eliminated. This conclusion is reached when the material(s) can be differentiated from the exemplar, there is sufficient quantity of material for reliable and reproducible results, and no inseparable mixing or deleterious change is indicated.

3.5 An Examiner may assert the approximate limits of the areal extent of a geologic body based on published map data**.**

4 Statements Not Approved For FBI TEU Mineralogy Group Forensic Geology Comparisons Testimony and/or Laboratory Reports

4.1 An Examiner shall not assert that two or more geologically-derived materials were once part of the same broken object unless they physically fit together.

4.2 When offering a “fracture fit” conclusion, an Examiner shall not assert that the geologically-derived materials originated from the same object to the exclusion of all other objects.

4.3 An Examiner shall not offer an “inclusion” conclusion unless they explain that the geologically-derived materials could also have originated from additional geologically-derived sources that are indistinguishable in all assessed characteristics.

4.4 An Examiner may not assert that a geologically-derived materials exemplar is representative of all geologically-derived materials in the area of interest.

4.5 An Examiner may not assert that the boundaries of a homogenous geologically-derived material can be predicted with absolute certainty.

4.6 An Examiner shall not assert that the total number of objects within a group of similar geologically-derived materials can be predicted with absolute certainty.

4.7 An Examiner shall not assert that forensic geologically-derived materials examinations are infallible or have a zero error rate.

4.8 An Examiner shall not provide a conclusion that includes a statistic or numerical degree of probability except when based on relevant and appropriate data.

4.9 An Examiner shall not cite the number of forensic geologically-derived materials examinations performed in their career as a direct measure for the accuracy of a proffered conclusion.

4.10 An Examiner shall not use expressions "reasonable degree of scientific certainty", "reasonable scientific certainty", or similar assertions of reasonable certainty in either reports or testimony unless required to do so by a judge or applicable law.

5 Laboratory Report Reviews

The content of a Mineralogy Group *Laboratory Report* will be reviewed per the appropriate FBI Laboratory Operations Manual practices and the Trace Evidence Casework Assignment and Review Procedures to ensure compliance with the approved statements in this document.

6 Testimony Reviews

Mineralogy Group testimonies will be reviewed following the FBI Laboratory Operations Manual, Practices for Testimony Related Activities. The review will assess the testimony for compliance with the statements in this document.

7 References

- FBI Laboratory Quality Assurance Manual (current version)
- FBI Laboratory Operations Manual (current version)
- Trace Evidence Quality Manual (current version)
- Trace Evidence Procedures Manual (current version)
- Department of Justice Uniform Language for Testimony and Reports (ULTR) for the Forensic Geology Discipline (current version)

Rev.#	Issue Date	History
1	11/24/15	Section 3.2 changed Technical Leader to Technical Reviewer.
2	02/07/18	Updated throughout removing references to TEU where appropriate. Changed Report of Examination to Laboratory Report throughout. Wording in Section 3 edited for uniformity with other TEU documents and added language regarding comparisons. Section 3.4 changed designee to supervisor and added reference to LOM Practices for Court Testimony Monitoring. Section 4 added reference to Trace Evidence General Approach to Report Writing. Headings for Sections 4 and 5 changed to reflect new document title. Added inseparable to Sections 4.1.3, 4.1.4, 4.2.3 and 4.2.4. Document references updated throughout document. Updated references in Section 10.
3	01/31/19	Removed Section 3 “Responsibilities”. Section 3.1 and 3.2 merged as Section 3, and all references to “Geologic Materials” changed to “Geologically-derived Materials” throughout entire document. “Geologically-derived Materials” defined in Scope. Section 4.1 and 4.2 merged to section 4. Sections 3 and 4 renumbered. Section headings added in Sections 3.1 through 3.4. Minor wording changes to Sections 3.1 through 3.4 to conform to Department of Justice Uniform Language for Testimony and Reports (ULTR) for the Forensic Geology Discipline wording. Section 3.5 wording modified. Sections 4.2, 4.3, and 4.6 through 4.10 added. Added reference to the Geology ULTR.

Approval

Redacted - Signatures on File

Trace Evidence Unit Chief — Date: 01/30/2019

Mineralogy Technical Leader — Date: 01/30/2019

QA Approval

Quality Manager — Date: 01/30/2019

FBI Approved Standards for Scientific Testimony and Report Language For Forensic Glass Comparisons

1 Purpose

This document provides examples of scientifically-supported conclusions and opinions approved for reporting examination conclusions and offering expert opinion statements during testimony by Geologist/Forensic Examiners conducting forensic glass comparisons within the Mineralogy Group of the Trace Evidence Unit (TEU). These examples are not intended to be all inclusive. The actual statements that may be provided in a particular case may be subject to prior legal precedent in the locality in which a testimony is provided. Further, these examples are not intended to serve as requirements for other forensic laboratories and do not imply that statements by other forensic laboratories are incorrect, indefensible, or erroneous. Explanations supporting the statements contained in this document can be found in the FBI Laboratory Quality Assurance Manual, FBI Laboratory Operations Manual, Trace Evidence Quality Assurance Manual, Trace Evidence Procedures Manual, and current reliable references.

2 Scope

This document applies to Geologist/Forensic Examiners within the TEU Mineralogy Group who prepare FBI *Laboratory Reports* (7-1 or 7-1 LIMS) and/or provide testimony in the area of forensic glass analysis.

3 Statements Approved for FBI TEU Mineralogy Group Forensic Glass Comparison Testimony and/or Laboratory Reports

For additional guidance on report writing, see the General Approach to Report Writing, Trace Evidence Quality Manual.

3.1 Fracture Fit: An Examiner may assert that the glass fragments were once part of the same broken object. This conclusion can only be reached when two or more pieces of broken glass physically fit together and show sufficient correspondence between their macro- and microscopic characteristics to indicate they once comprised a single object, and insufficient disagreement between their macro-and microscopic characteristics to conclude that they originated from different objects.

3.2 Inclusion: An Examiner may assert that the glass fragments either originated from the same broken glass source or from another source(s) of broken glass with indistinguishable characteristics. This conclusion may be reached with or without elemental composition.

3.2.1 Inclusion with Elemental Composition Examination: If elemental composition data *has* been acquired, an Examiner may conclude that two or more glass fragments either originated

from the same broken glass source or from another source that is indistinguishable in all assessed physical characteristics, refractive index, and elemental composition. Such conclusions may include probabilities based on appropriate databases or documented frequencies.

3.2.2 Inclusion with No Elemental Composition Examination: If elemental composition data *has not* been acquired, an Examiner may conclude that two or more glass fragments either originated from the same broken glass source or from another source that is indistinguishable in all assessed physical characteristics and refractive index. Such conclusions may include probabilities based on appropriate databases or documented frequencies. When elemental composition data has not been acquired, an examiner shall report and explain that the chance of finding glass that is coincidentally indistinguishable in all assessed characteristics is significantly higher than when it is acquired.

3.3 Exclusion: An Examiner may assert that two or more glass fragments are excluded as having originated from the same broken glass source. This conclusion is reached when two or more fragments of glass are different in their assessed physical properties, refractive indices or elemental composition.

3.4 Inconclusive: An Examiner may assert that no determination can be reached as to whether two or more glass fragments could have originated from the same source of broken glass. This conclusion can be reached when a glass fragment is too limited in size or quality.

3.5 An Examiner may cite the number of forensic glass examinations performed in their career for the purpose of establishing, defending, or describing their qualifications or experience.

4 Statements Not Approved For FBI TEU Mineralogy Forensic Glass Comparison Testimony and/or Laboratory Reports

4.1 An Examiner shall not assert that two or more broken glass fragments were once part of the same object unless the broken glass fragments physically fit together.

4.2 When offering a “fracture fit” conclusion, an Examiner shall not assert that the fragments originated from the same broken glass object to the exclusion of all other broken glass sources.

4.3 An Examiner shall not offer an “inclusion” conclusion unless they explain that the glass fragments could also have originated from another broken glass source(s) that is indistinguishable in all assessed characteristics.

4.4 An Examiner shall not assert that forensic glass examinations are infallible or have a zero error rate.

4.5 An Examiner shall not provide a conclusion that includes a statistic or numerical degree of probability except when based on relevant and appropriate data.

4.6 An Examiner shall not cite the number of forensic glass examinations performed in their career as a direct measure for the accuracy of a proffered conclusion.

4.7 An Examiner shall not use expressions "reasonable degree of scientific certainty", "reasonable scientific certainty", or similar assertions of reasonable certainty in either reports or testimony unless required to do so by a judge or applicable law.

5 Laboratory Report Reviews

The content of a TEU Mineralogy Group *Laboratory Report* will be reviewed per the appropriate FBI Laboratory Operations Manual practices and the Trace Evidence Casework Assignment and Review Procedures to ensure compliance with the approved statements in this document.

6 Testimony Reviews

TEU Mineralogy Group testimonies will be reviewed following the FBI Laboratory Operations Manual, Practices for Testimony Related Activities. The review will assess the testimony for compliance with the statements in this document.

7 References

- FBI Laboratory Quality Assurance Manual (current version)
- FBI Laboratory Operations Manual (current version)
- Trace Evidence Procedures Manual (current version)
- Trace Evidence Quality Manual (current version)
- Department of Justice Uniform Language for Testimony and Reports (ULTR) for the Forensic Glass Discipline (current version)

Rev.#	Issue Date	History
1	02/07/18	Updated throughout removing references to TEU where appropriate. Changed Report of Examination to Laboratory Report throughout. Wording in Section 3 edited for uniformity with other TE documents. Section 3.4 changed designee to supervisor and added reference to LOM Practices for Court Testimony Monitoring. Section 4 added reference to Trace Evidence General Approach to Report Writing. Document references updated throughout document.
2	01/31/19	Section 3 “Responsibilities” section deleted. Changed Sections 3.1 through 3.4, deleted Section 4.5 and added Sections 3.2.1 and 3.2.2, 4.2 through 4.7 to conform to Department of Justice Uniform Language for Testimony and Reports (ULTR) for the Forensic Glass Discipline (Glass ULTR) Added reference to the Glass ULTR. Section 4.5 added.

Approval Redacted - Signatures on File

Trace Evidence Unit Chief Date: 01/30/2019

Mineralogy Technical Leader Date: 01/30/2019

QA Approval

Quality Manager Date: 01/30/2019