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Standard for Developing Standard Operating Procedures in Bloodstain Pattern Analysis

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Foreword

Standard operating procedures are an essential component of a quality assurance program. A quality assurance program is necessary to ensure the quality of the work product and to provide guidance to agencies providing bloodstain pattern analysis services.

It is recognized that Bloodstain Pattern Analysis is practiced by individuals employed by a variety of agencies offering forensic services. For accredited laboratories that already have an established quality assurance program and standard operating procedures, this document is not intended to supplant the quality standards set forth by accreditation, but may assist these agencies in the refinement of their program relative to BPA. In addition, this document is intended to provide the framework for other agencies and individuals in the establishment of standard operating procedures.

The American Academy of Forensic Sciences established the Academy Standards Board (ASB) in 2015 with a vision of safeguarding Justice, Integrity and Fairness through Consensus Based American National Standards. To that end, the ASB develops consensus based forensic standards within a framework accredited by the American National Standards Institute (ANSI), and provides training to support those standards. ASB values integrity, scientific rigor, openness, due process, collaboration, excellence, diversity and inclusion. ASB is dedicated to developing and making freely accessible the highest quality documentary forensic science consensus Standards, Guidelines, Best Practices, and Technical Reports in a wide range of forensic science disciplines as a service to forensic practitioners and the legal system.

This document was revised, prepared, and finalized as a standard by the Bloodstain Pattern Analysis Consensus Body of the AAFS Standards Board. This document originated as a product of the Scientific Working Group on Bloodstain Pattern Analysis (SWGSTAIN)[a]. The draft of this standard was developed by the Bloodstain Pattern Analysis Subcommittee of the Organization of Scientific Area Committees (OSAC) for Forensic Science.

Questions, comments, and suggestions for the improvement of this document can be sent to AAFS-ASB Secretariat, asb@aafs.org or 401 N 21st Street, Colorado Springs, CO 80904.

All hyperlinks and web addresses shown in this document are current as of the publication date of this standard.

ASB procedures are publicly available, free of cost, at www.aafs.org/academy-standards-board.

Keywords: *Bloodstain pattern analysis, standard operating procedures, quality assurance.*

[a] *Scientific Working Group on Bloodstain Pattern Analysis: Guidelines for Developing Standard Operating Procedures in Bloodstain Pattern Analysis* and its related Appendix, SWGSTAIN.org

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Standard for a Developing Standard Operating Procedures in Bloodstain Pattern Analysis

1 Scope

This standard provides guidance on the development of Standard Operating Procedures (SOP) that are a component of the quality assurance program for Bloodstain Pattern Analysis. The standard specifies SOP requirements for equipment, materials, reagents, calculations, documenting limitations, safety and the generation of reports. The standard is applicable to scene, laboratory and remote examinations.

2 Normative References

The following reference is indispensable for the application of the standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ANSI/ASB, Standard 031, *Standard for Report Writing in Bloodstain Pattern Analysis*, First Edition 2020

3 Terms and Definitions

For purposes of this document, the following definitions apply.

3.1
Forensic Science Service Provider
FSSP
A forensic science agency or forensic science practitioner providing forensic science services.

3.2
reagent
A chemical used to react with another chemical, often to confirm or deny the presence of the second chemical.

4 Requirements

4.1 Standard Operating Procedures (SOP) Scope

Implementation of an SOP requires a well-defined scope as it relates to bloodstain pattern analysis (BPA) performed by the Forensic Science Service Provider (FSSP). The FSSP shall define the scope of the SOP as it relates to BPA performed by the FSSP.

4.2 Equipment, Materials, and Reagents

4.2.1 The SOP shall detail the equipment, materials, and reagents used in the course of the BPA.

4.2.2 Where essential to the quality of the examination, the FSSP shall identify the operational parameters of these items. (Refer to Annex A - Equipment, Materials, and Reagents Examples.)

4.3 Procedures

4.3.1 General

The SOP shall include and explain procedures used

4.3.2 Information Retrieval

The SOP shall define the process of retrieval and dissemination of case specific information to assist in the BPA. The SOP shall, to the extent possible, balance the need for case information and the possibility of bias that might result from the exposure to that information. In accordance with its written applicable procedures, the FSSP should triage information to mitigate bias. At minimum, the date of receipt of case information ~~shall~~should be documented.

The information to consider for retrieval and dissemination includes, but is not limited to, the following.

a) Relevant photographs/videos.

b) The location and number of scenes, scene accessibility, and scene conditions (e.g., indoors or outdoors, environmental conditions, public or private).

c) Persons having had access to the scene and the extent of their involvement (e.g., witness, first responders, medical personnel).

d) Relevant reports, statements, and consultations.

e) Whether other blood-shedding events are known to have occurred prior to, or after, the event in question.

f) Previously observed condition of the bloodstains (e.g., original bloodstain conditions prior to first responder intervention).

g) Information relating to the bleeding persons, such as:

   1) number of bleeding persons;

   2) cause and manner of death and/or injury and weapons involved, if known;

   3) post-mortem interval or time of event, if known;

   4) location and types of wounds.

h) Other known sources of bleeding (e.g., animals).

i) Information related to seized evidence items (e.g., clothing, weapons, etc.) such as:

   1) time, location, and condition of items when seized;

   2) history of time after seizure (e.g., chain of custody, prior examination, packaging and storage conditions);

3) results of any previous processing or testing of the crime scene or submitted items (e.g., presumptive or DNA testing);

4) specific questions or issues of the submitting agency which the BPA is requested to assist.

4.3.3 Pre-examination Preparation and Planning

4.3.3.1 The SOP shall outline the use of examination equipment, and personal and scene protective equipment. (Refer to Annex A - Equipment, Materials, and Reagents Examples.)

4.3.3.2 The SOP shall identify factors that can affect the need for assistance from other specialists. These factors include, but are not limited to the following.

a) Scene security and safety.

b) Multidisciplinary considerations and sequencing of examinations (e.g., latent print examination, trace evidence, serology/DNA testing, Crime Scene Reconstructionist).

c) Additional BPA personnel.

d) Analyst and investigator communication.

e) Technical support personnel.

4.3.4 Data Collection

4.3.4.1 The SOP shall identify factors to consider when conducting a preliminary examination of the scene or item. These factors include, but are not limited to the following.

a) Initial walk-through of the scene.

b) Documentation of physical information from the scene that can affect the BPA (e.g., temperature, humidity).

c) Acquisition of photographs, images, video.

d) Awareness of potential transient evidence.

4.3.4.2 The SOP shall define the methods to be considered for documenting the scene or item. These methods include, but are not limited to 4.3.3.2.1 through 4.3.3.2.4.

4.3.4.2.1 The SOP shall identify factors to be considered for the photography or videography of the scene or item. These factors include, but are not limited to the following.

a) Image capturing, file format, storage, and security.

b) Capturing of overall, midrange (evidence establishing), and close-up images.

c) Use of scales and unique identifiers.

d) Use of any specialized image capturing (e.g., photomicrography, IR/UV photography).

4.3.4.2.2 The SOP shall provide guidelines of sketching the scene or item. It is recommended that the scene or item be sketched with particular emphasis on the location of the bloodstain patterns. The sketch can assist in a more focused examination by showing the spatial relationship of each bloodstain pattern to other stain patterns or to objects at the scene. Sketches need not be to scale, yet relevant measurements shall be collected to ensure the approximate spatial relationships of the evidence within the scene is preserved. Failure to collect relevant measurements due to scene conditions shall be documented.

4.3.4.2.3 The SOP shall identify factors to be considered when generating notes. These factors include, but are not limited to the following.

a) The collection of notes, for example:

    1) written;

    2) audio recorded; and

    3) other digital methods.

b) Comprehensive detail to allow for the review and recollection at a later time.

c) Notes content, for example:

    1) case identifier(s);

    2) identity of the examiner(s);

    3) location and date of activities;

    4) description of the size, shape, distribution, location and appearance of stains within the bloodstain patterns using well defined and consistent terminology (Refer to ASB Technical Report 033, *Terms and Definitions in Bloodstain Pattern Analysis*);

    5) absence of staining (including voids), if relevant;

    6) description of the environmental/physical conditions of the scene that may have affected the BPA;

    7) description of the test(s) and enhancement technique(s) performed, test results, appropriate controls, reagent lot numbers, and the identity of the individual(s) performing these tests;

    8) description of any evidence collected and the identity of the individual(s) performing the collection(s);

    9) description of any other activities performed in the support of the BPA (e.g., use of IR imaging, laser scanners).

4.3.4.2.4 The SOP shall define the methods and procedures utilized in the collection of analytical data relevant to blood source location (e.g., area of origin, area of convergence, etc.).

4.3.4.3 The SOP shall identify the operational parameters involving the use of presumptive testing, species origin, and other biological fluid testing (e.g., amylase testing), as appropriate; including the use of testing controls, reagent lot numbers, and the evaluation, documentation, and reporting of test results.

4.3.4.4 The SOP shall identify the factors to be taken into consideration for the collection of evidence for biological analysis. These factors include, but are not limited to the following.

a) Number of known blood sources.

b) Location and number of stains and stain patterns.

c) Timing of the blood collection (so as to not interfere with the BPA).

d) Methods of collection and packaging.

e) Collection of appropriate control samples.

4.3.4.5 The SOP shall identify factors affecting the use of blood searching and visual enhancement techniques.

4.3.4.6 The SOP shall identify factors to consider for the completion of a final survey of the scene or item. These factors include, but are not limited to the following.

a) Review of preliminary findings and documentation.

b) Discussions with other personnel, as appropriate.

c) Review of evidence collected.

d) Removal of non-disposable BPA equipment and supplies.

e) Disposal of waste.

4.3.5 Data Review and Analysis

4.3.5.1 The SOP shall outline the procedures for reviewing and analyzing the collected data and other associated information to generate conclusions regarding the BPA.

4.3.5.2 The SOP shall describe the review and analysis of materials and documentation. For example:

a) reports;

b) notes;

c) sketches;

d) images;

e) recordings (e.g., video, audio).

4.3.5.3 The SOP shall describe factors used to identify viable mechanisms that could produce the patterns under consideration. Some factors include, but are not limited to:

a) scene context;

b) complexity of the patterns;

c) area of origin determination (e.g., string line, tangent, computer analysis);

d) post-event intervention(s);

e) terminology;

f) relevant literature;

g) training and experience;

h) limitations.

4.3.5.4 The SOP shall ensure the documentation of materials made available during the analysis. For example:

a) reports and other related materials (e.g., medical records, autopsy reports, photographs, videos, lab reports, investigative reports, and scene diagrams);

b) statements;

c) other experts' reports and statements.

4.3.5.5 The SOP shall identify the need to design and conduct case-specific BPA experiments, when necessary.

5 Report Generation, Review, and Approval

5.1 The SOP shall comply with the requirements in ANSI/ASB, Standard 031, *Standard for Report Writing in Bloodstain Pattern Analysis*, First Edition, 2020, for report generation.

5.2 The SOP shall outline the criteria for report generation, review, and approval to include:

a) FSSP's criteria under which a report will be generated;

b) the elements of the report; and

c) the FSSP's process for technical and administrative review.

6 Calculations

The SOP shall identify the calculations used within the BPA. These calculations include, but are not limited to:

a) angle of impact;

b) area of origin.

7 Documenting Limitations

The SOP shall ensure factors and circumstances affecting the analysis of the bloodstain patterns and the subsequent conclusions are documented. The factors to consider include, but are not limited to:

a) lack of blood source information;

b) environmental factors;

c) scene integrity;

~~d) measurement precision;~~

~~e)~~d) measurement uncertainty for calculated values;

~~f)~~e) calculation limitations and outcomes;

~~g)~~f) evidence history and condition;

~~h)~~g) quality of documentation and photography;

~~i)~~h) contextual bias;

~~j)~~i) partial or incomplete and overlapping patterns;

~~k)~~j) target surface effects;

~~l)~~k) post event activity.

8 Safety

The SOP shall identify safety issues regarding the exposure to physical, chemical, and biological hazards.

9 References

The SOP shall list all source material used in the development of the SOP.

10 SOP Approval

The SOP shall include a process for documenting the approval and periodic review of the SOP.

11 Revision History

The SOP shall outline the documentation of revisions and changes since the previous version.

Annex A
(informative)

Equipment, Materials, and Reagents Examples

This annex provides examples of equipment, materials and reagents that may comprise the "Equipment, Materials and Reagents" portion of an FSSP's SOP for BPA (Section 4). This list is not intended to be all-inclusive.

A.1 Personal and Crime Scene Protection

— Disposable personal protective equipment suitable for biohazard investigations (e.g., coveralls, gloves, shoe covers)

— Respiration protection

— Eye protection

— Disinfecting agents (e.g., towelette, antibacterial solution)

— Stepping plates

— Paper roll

— Barrier tape

— Biohazardous waste containers

— First aid kit

A.2 Measurement Equipment

— Single stain measurement devices (e.g., dividers, calipers, magnifying loupe, computer software)

— Angle of impact devices (e.g., level and angle finder, protractor, geometric triangle, computer software)

— Ruler and tape measure

— Plumb bob

— Strings in different colors

— Adhesive tape

— Dowel rods

— String support pole or tripod

— Scientific calculator

— Lasers (e.g., levels, distance measuring)

A.3 Magnification Equipment

— Stereomicroscope

— Lighted magnifier

— Hand held digital magnifier

A.4 Illumination Equipment

— High intensity light sources

— Forensic light source and appropriate filters

— Flashlights

— Extension cords, power supply

A.5 Photographic Equipment

— Camera and media generally accepted for crime scene documentation

— Interchangeable lenses

— Flash equipment (e.g., speedlight, ring flash)

— Digital cards or film

— Cable release

— Batteries

— Video camera and media

— Tripod

— Color balance card

A.6 Markers, Identifiers, and Documentation Equipment

— Adhesive labels (e.g., arrows, rulers, numbers or letters)

— Metric scales (e.g., photo evidence scales, folding scales, adhesive scales, fluorescent scales, L-shaped scales)

— Compass with 360° scale

— Number, letter or arrow placards

— Crime scene flags

— Note taking and sketching materials (e.g., notebook, graph paper, pencils, markers)

— Audio recorder and media

A.7 Collection Supplies

— Filter paper

— Sterile cotton tipped swabs, swatches

— Disposable scalpels

— Tweezers

— Water (e.g., distilled or sterilized)

— Evidence packaging (e.g., paper evidence bags, plastic evidence bags, evidence boxes, evidence collection tubes, evidence integrity tape, evidence tags, chain of custody labels)

— Scissors

— Blood collection tubes

— Adhesive biohazard labels and seals

A.8 Reagents

— Biological Fluids

— Presumptive blood tests [e.g., phenolphthalin, tetramethylbenzidine (TMB)]

— Immunologic species origin tests

— Saliva tests

— Visual blood enhancement chemicals [e.g., amido black, leucomalachite green (LMG), leuco crystal violet (LCV)]

— Blood searching chemicals (e.g., luminol, fluorescein)

Annex B
(informative)

Bibliography

The following bibliography is not intended to be an all-inclusive list, review, or endorsement of literature on this topic. The goal of the bibliography is to provide examples of publications addressed in the standard.

1] ASB Technical Report 033, *Terms and Definitions in Bloodstain Pattern Analysis*, First Edition, 2017[2]

[2] Available from www.aafs.org/academy-standards-board

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