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1.0 Introduction

Bloodstain pattern analysis (BPA) is a scientific study of the static consequences resulting from dynamic blood shedding events and the physical properties of blood in motion. The study involves detecting, describing, and analyzing the size, shape, distribution, number, location and pattern of bloodstains, as well as the nature of their target surface and the relationship among various bloodstains at a scene or on submitted items. It relies on the fact that blood is a fluid, and as such, it adheres to physical laws. BPA applies mathematics, trigonometry, and scientific principles from biology, physics and fluid dynamics.

Bloodstain patterns from crime scenes and on submitted items can yield valuable investigative information, reconstruct events and support or disprove statements made by people associated to the events that created the bloodstain patterns.

1.0.1 BPA Requests for Analysis

Details for requests and submissions to the laboratory for BPA can be found in the Evidence Submission Policies of the Laboratory Operations Manual (LOM).

1.1 Scope

This BPA Procedures Manual is for use by Michigan State Police (MSP) Forensic Science Division (FSD) personnel while performing bloodstain pattern analysis inside and outside the laboratory.

This manual is not all-inclusive and will reference other sources where appropriate. It is always the analyst's responsibility to choose the best analytical scheme for each individual case based on their training, knowledge, skills and experience.

1.2 Purpose

The purpose of this manual is to serve as a source of information for bloodstain pattern analysts on procedures for the recognition, documentation, collection and analysis of bloodstains and bloodstain patterns.

Deviations from this procedures manual shall be approved by the BPA Technical Leader and documented in the case file.

This manual in combination with the BPA Training Manual provide the basis for effective quality management of MSP FSD's bloodstain pattern analysis personnel. The FSD's Quality Manual (QM), Laboratory Operations Manual (LOM) and Health and Safety Manual provide additional information.

1.3 Goal

To provide the highest quality objective BPA to assist the criminal justice system throughout the state of Michigan.

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1.4 Objectives

To accomplish our goal through:

- Responding to crime scenes to recognize, document and collect samples from bloodstain patterns
- Analyze bloodstains on items submitted to the laboratory
- Consult with and educate the criminal justice community
- Compile comprehensive objective case files to support the analysis
- Issue objective BPA reports
- Provide objective courtroom testimony
- Provide objective assistance to the court with other BPA reports and/or testimony from experts outside MSP FSD

1.5 Quality Assurance

All bloodstain pattern analysts will work to continually maintain the highest degree of quality, objectivity and integrity of laboratory services as it relates to BPA. All bloodstain pattern analysts are required to familiarize themselves with this manual and the FSD Quality Assurance Manual to ensure they are implementing FSD quality assurance policies and procedures to their work.

While performing duties as a bloodstain pattern analyst, personnel should:

- Be independent, impartial, detached and objective approaching the analysis with due diligence and an open mind
- Conduct full and fair examinations and come to conclusions based on evidence, facts, training, knowledge, and experience and not on extraneous non-factual information, political pressure or other outside influences
- Be aware of limitations and only render conclusions that are within their area of expertise
- Communicate honestly with all parties
- Consider alternate hypotheses

1.5.1 Relationship with Person(s) Involved

Analysts shall not perform BPA on cases involving person(s) who they are knowingly related to or have a close relationship to. If person(s) involved are not known prior to and/or during analysis and it is later determined there is a relationship to a person involved, it shall be documented in the case file and the analyst shall remove themselves from any further BPA at the time of discovery of the relationship.

1.5.2 Analyst(s) Absent from or Not Completing Casework for a Calendar Year

Any analyst that has been away from work, not authored a BPA report and/or technically reviewed a BPA report for a calendar year shall notify the Technical Leader at the end of that calendar year via email. The Technical Leader shall re-evaluate that analyst and determine if retraining is necessary. If retraining is necessary, the Technical Leader shall devise a retraining program specific for the analyst(s) and oversee its successful completion. A competency test shall also be completed at the conclusion of the retraining.

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1.5.3 Method Validation

New methods and modifications to established methods and procedures within this manual shall be validated according to the requirements of the LOM with approval from the Technical Leader or designee.

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2.0 Safety Precautions

Analysts should be cognizant of the fact that crime scenes and bloodstained items present a significant risk of transmitting infectious disease and take the necessary precautions to protect themselves and their coworkers.

Personal protective equipment (PPE) and other protective measures shall be available to analysts during their analysis to include at least:

- Latex and/or nitrile gloves
- Shoe/boot covers
- Tyvek type suits
- Dust masks and/or surgical masks
- Respirators
- Safety glasses, face shields and/or goggles

Standard laboratory safety protocols should be followed whenever possible at crime scenes and in the laboratory. Please refer to the MSP FSD Health and Safety Manual for specific protocols.

For chemical safety of reagents used, please refer to the sections of the Crime Scene Procedures Manual that correspond with the reagent being used.

2.1 Incompatible activities

To prevent contamination during analysis, the appropriate PPE shall be utilized as necessary for the situation. Surgical masks or other appropriate PPE shall be worn when examining submitted items that may need to be further analyzed for DNA.

2.1.1 Suspect and Victim Items

When a case requires the examination of suspect and victim items, these precautions should be taken:

- Do not have suspect and victim items open at the same time or in the same area/room
- When possible examine suspect and victim items in different areas/rooms within the laboratory
- Examine suspect and victim items on separate days
- Thorough decontamination of equipment and surface that could cross transfer evidence between suspect and victim items

2.2 Adverse Environmental Conditions

For BPA performed at crime scenes, the crime scene may be established anywhere and can be affected by a variety of environmental conditions and physical adversities. When possible, crime scenes and evidence should be protected from these conditions and adversities. When it is suspected that conditions could affect the validity of results of testing, processing and/or collection, it should be thoroughly documented. In these situations, if it is possible to change the conditions or perform the techniques at a more suitable location, every effort should be made to do so.

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2.3 Decontamination

Personnel should decontaminate themselves and their clothing at the conclusion of the crime scene to avoid transferring hazardous material to the crime scene response vehicle. Equipment that was utilized during the BPA or at the crime scene and has been contaminated or could cross contaminate the next time utilized shall be decontaminated with a ~10% bleach solution or other appropriate sanitizing cleaner/wipes.

2.4 Safety Responsibilities of Bloodstain Pattern Analysis Personnel

Analysts are responsible for being aware of the hazards of the chemicals and materials being used during training and casework, and they are responsible for knowing how to safely handle them.

Each analyst is responsible to

- wear the appropriate personal protective equipment and know when it is required
- follow the safety procedures set forth in the MSP FSD Health and Safety Manual and this procedures manual

2.5 Critical Incident Stress/Trauma

Please refer to Section 2.5 of the Crime Scene Procedures for information and resources to help with critical incident stress and trauma that can result for casework.

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3.0 BPA Personnel

The organizational chart for the discipline of bloodstain pattern analysis can be found at the end of this section.

3.1 Bloodstain Pattern Analyst

An analyst that has been trained to competency and authorized to conduct casework in the discipline of BPA. A bloodstain pattern analyst is authorized to perform all aspects of the analysis of bloodstain patterns to include:

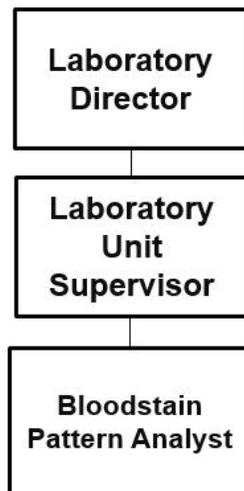
- Documentation, recognition and analysis at the crime scene
- Presumptive testing of blood
- Analysis of bloodstain patterns on clothing and items submitted to the laboratory
- Analysis of bloodstain patterns from digital images submitted to the laboratory
- Area(s) or convergence and origin determination(s)
- Reconstruction
- Authoring bloodstain pattern analysis reports to include conclusions/opinions
- Providing expert witness testimony in the discipline of bloodstain pattern analysis

3.2 Bloodstain Pattern Analyst Trainee

A forensic scientist, state police specialist or other FSD lab personnel that is currently training in BPA but has not completed all of the training. Under direct supervision, the trainee can assist an analyst with any aspect of bloodstain pattern recognition, documentation, collection, analysis and/or other tasks as deemed appropriate by the analyst overseeing them.

Trainees are not authorized to independently perform analysis, author, or technically review bloodstain pattern analysis reports.

3.3 Bloodstain Pattern Analysis Organizational Chart



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4.0 Equipment and Products

The equipment and products utilized in bloodstain pattern analysis at the crime scene and in the lab can be found in Section 4.0 of the Crime Scene Procedures Manual and that section of procedure in its entirety should be followed when utilizing them for bloodstain pattern analysis.

For personal protective equipment, please refer to Section 2.0 of this manual.

4.1 Area of Origin (AOO) Rulers

NIST certified rulers or other AOO rulers (detailed below) shall be utilized for convergence-to-spatter stain distance measurements when performing area of origin determinations. These rulers shall be marked with a label that includes a unique equipment designator of the two-letter lab identifier (e.g., BP) followed by a dash followed by "AOO" followed by a dash and a number (e.g. BP-AOO-1) which signifies it is NIST certified.

Other AOO rulers can be used for the convergence-to-spatter stain distance measurements, but they shall be checked with a ruler that has a certificate of calibration (preferably NIST certified) prior to being placed into service and an entry made in the "New Equipment-Product" tab of the CSRT equipment log. The serial number or other identifier of the metal ruler with certificate of calibration shall be recorded with the entry in the equipment log. The tolerance for being approved for use is 0.5mm over the length of the ruler. Rulers that pass this check shall be marked with a label as described above: Lab ID – AOO - # which signifies it has passed and can be used.

4.1.1 Damaged AOO Rulers

AOO rulers that appear damaged (e.g., bent, warped, numbers/markings worn off, etc.) shall be discarded and replaced. An entry shall be made in the CSRT equipment log showing it was removed and the new replacement ruler added.

4.2 Externally Provided Products

Except for the chemicals and reagents that are obtained from laboratory units for blood testing/detection, any vendor can be used to purchase externally provided products for bloodstain pattern analysis.

4.3 Equipment for Analysis in the Laboratory

Analysis of bloodstains and bloodstain patterns on items submitted to the laboratory may require additional laboratory equipment not detailed in the Crime Scene Procedures Manual. The following list of equipment is not all encompassing and other laboratory equipment may be necessary. When using the equipment listed below and any other laboratory equipment, please refer to and abide by applicable laboratory procedures and manufacturer instructions pertaining to the equipment being utilized.

- Lighted magnifier
- Microscope or stereomicroscope (preferably with attached camera)
- High intensity light source(s)

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5.0 Chemicals and Reagents

The procedures for chemicals and reagents utilized in bloodstain pattern analysis are detailed in the Crime Scene Procedures Manual. These procedures shall be followed for any chemical testing performed for bloodstain pattern analysis.

Deviations in the use of chemicals and reagents are left to the discretion of the analyst but shall be documented in the case file to include why the deviation was necessary.

5.1 Reporting for Areas Tested and/or Processed During the Bloodstain Pattern Analysis

When reporting results, analysts shall report the following:

- Reagent used
- Area(s) tested
- Test result(s) and what it indicates (including negative testing results for areas tested)

For example:

- The red-brown stain on the kitchen counter near the sink (L-5) tested phenolphthalein positive indicating the possible presence of blood.
- The east bedroom floor was processed with leucocrystal violet, and multiple transfer stains of possible footwear impressions (A-D) developed indicating the possible presence of blood.
- The vehicle trunk was processed with luminol and an area of apparent spatter stains luminesced indicating the possible presence of blood.

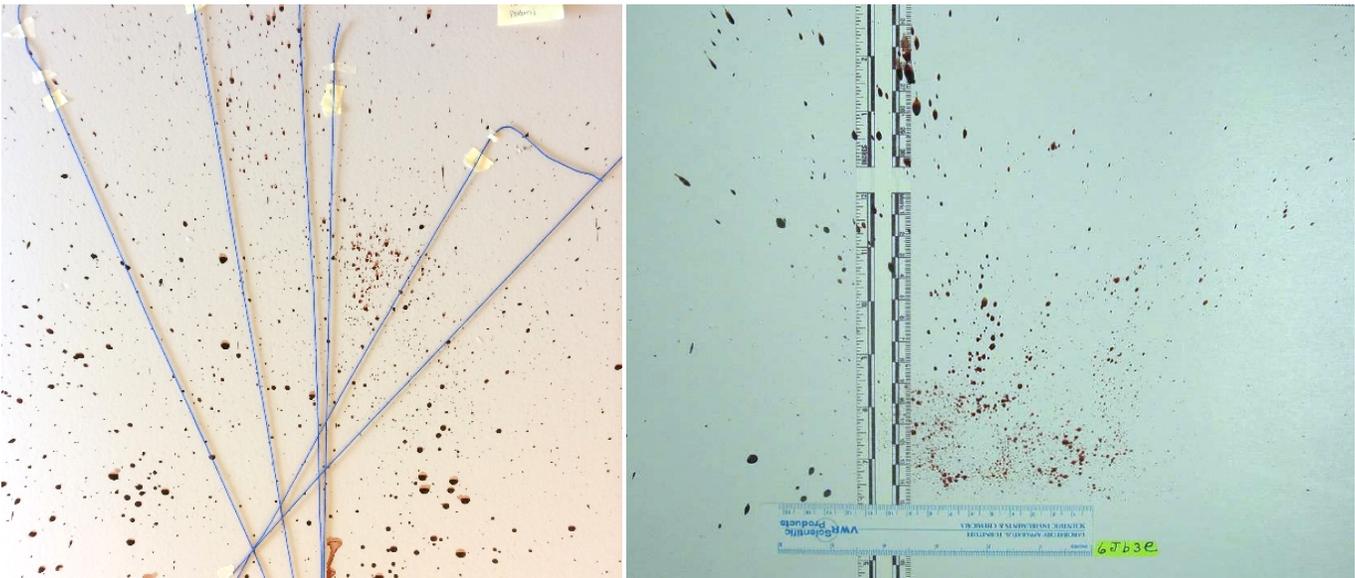
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6.0 Documentation and Collection of Spatter Stains for Area of Convergence (AOC) and/or Area of Origin (AOO) Determination

Typically, AOC and AOO can only be determined for impact patterns to include forward and back spatter, but this portion of the procedures would also include any other types of spatter stains/patterns that contain characteristics that may allow for this type of analysis. Similar to other types of bloodstain patterns, these spatter patterns should be recorded to document their location, orientation, size and position with respect to the surface they are on through any combination of notes, sketches/diagrams and photographs.

6.1 Search for Spatter Patterns (AOC/AOO)

Spatter patterns may be found intertwined with other bloodstain patterns or isolated. Their typical appearance is a radiating pattern of spatter stains with directionality away from the AOC/AOO.



6.2 Notes of Spatter Patterns (AOC/AOO)

See the Crime Scene Procedures Manual, Section 13.2 Bloodstain Pattern Notes for proper note taking techniques. In addition to what is described there, spatter patterns may require more details be recorded. The range of sizes of spatter stains should be recorded (unless discernable in the photographs).

The stains selected for angle of impact calculation shall be noted with their stain identifier in the Angle of Impact and AOO Calculation spreadsheet or in a similar type table in the notes as described in Section 7 of this manual.

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6.3 Sketches/Diagrams and Measurements of Spatter Patterns (AOC/AOO)

6.3.1 Sketches/diagrams of Spatter Patterns (AOC/AOO)

Sketches/Diagrams can be created to establish the dimensions/measurements of the spatter pattern but may not be necessary due to the photographs that document these aspects of the pattern(s).

6.3.2 Measurements of Spatter Patterns (AOC/AOO)

The majority of the measurements of the pattern will be documented thru the photographs of the patterns as detailed below in the photography section. If necessary because it is not visible or able to be determined from the photographs, measurements should be recorded to approximate the location of the pattern and the range of sizes of spatter stains within the pattern.

Additional measurements will be necessary when determining the AOC and calculating the AOO. The procedures for those measurements are detailed in Section 7 of this manual.

6.4 Photographs of Spatter Patterns (AOC/AOO)

Each discernable spatter pattern that will be analyzed for AOC/AOO should be individually labeled and photographed utilizing the “road mapping” technique described in Section 13 of the Crime Scene Procedures Manual.

In addition, each spatter stain utilized for angle of impact determination shall be photographed with a scale and vertical plumb line (or North line if on a horizontal surface) visible in the field of view. These photographs should be taken utilizing the digital microscope to ensure the camera is parallel to the surface the spatter stain is on. If the field of view of the digital microscope is not large enough to capture the stain, plumb line and scale, another digital camera can be used. The digital microscope should still be used to capture a closeup photograph of the spatter stain for future measurement unless the spatter stain is too large to fit in the field of view.

6.5 Collection and Testing of Spatter Patterns (AOC/AOO)

When appropriate, smaller/portable items supporting spatter patterns (including sections of wall) can be collected for documentation and analysis back at the laboratory. Smaller/portable items should be photographed in detail and measured to document their location within the scene prior to being collected.

Presumptive testing at the scene and/or collection of stains or portions of patterns for future testing and/or DNA analysis is important. As deemed necessary, at least one representative stain from any pattern or area should be presumptively tested or collected for testing and potential DNA analysis back at the laboratory.

When bloodstains and/or patterns are obviously blood because of their proximity to areas or objects that are heavily bloodstained (e.g., a decedent with wounds and bloodshed, pools, heavy saturation stains, etc.) testing and/or collection for future testing/DNA analysis may not be necessary and is left to the discretion of the analyst.

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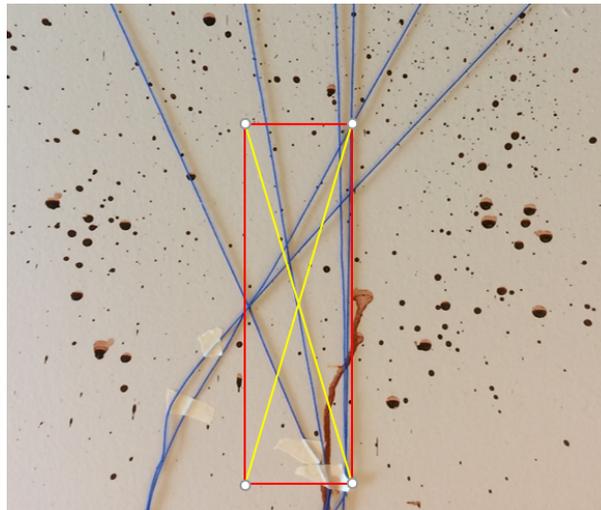
7.0 Bloodstain Pattern Analysis – Areas of Convergence and Origin

7.1 Determining Area of Convergence (AOC)

The area of convergence is the space in two dimensions to which the directionalities of spatter stains can be retraced to determine the location of the spatter producing event. Strings, tape or lines through or parallel to the long axis of the selected elliptical/oval spatter stains should be used. The AOC can then be determined using the intersections of these strings/tapes/lines.

To determine the area of convergence from these intersecting lines on a vertical surface (this method can also be applied to a horizontal surface):

1. Draw horizontal lines through the highest and lowest intersections
2. Draw vertical lines through the leftmost and rightmost intersections
3. This will create a rectangle
4. Draw diagonal lines from the corners of the rectangle and where they intersect is the central point of convergence



7.2 Determining Area of Origin (AOO)

The AOO is the space in three dimensions to which the trajectories of spatter can be utilized to determine the location of the spatter producing event. The following measurements and calculations shall be recorded in the “Angle of impact and AOO calculation spreadsheet” (found on the Discipline BPA folder on Qualtrax) when calculating the AOO:

- Width of spatter stain (W)
- Length of spatter stain (L)
- Angle of impact (θ)
- Convergence-to-spatter stain distance (utilizing an AOO ruler)
- Calculated convergence-to-origin distance



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7.2.1 Calculating Angle of Impact and AOO

The angle of impact and AOO calculation spreadsheet shall be used when AOO is going to be calculated (unless unavailable for some reason which shall be documented in the notes and the calculation then made manually). This spreadsheet will calculate the angle of impact of each spatter stain when the user inputs the length and width. It will also calculate the convergence-to-origin distance when the user inputs the convergence-to-spatter stain distance.

The spreadsheet uses the measurements and formulas in the following subsections to make the calculations.

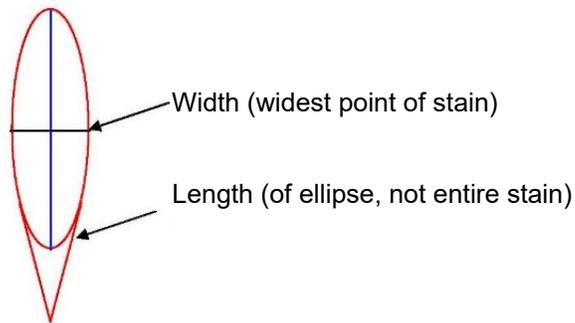
7.2.1.1 Calculating Impact Angle (θ):

$$\theta = \sin^{-1} (W / L)$$

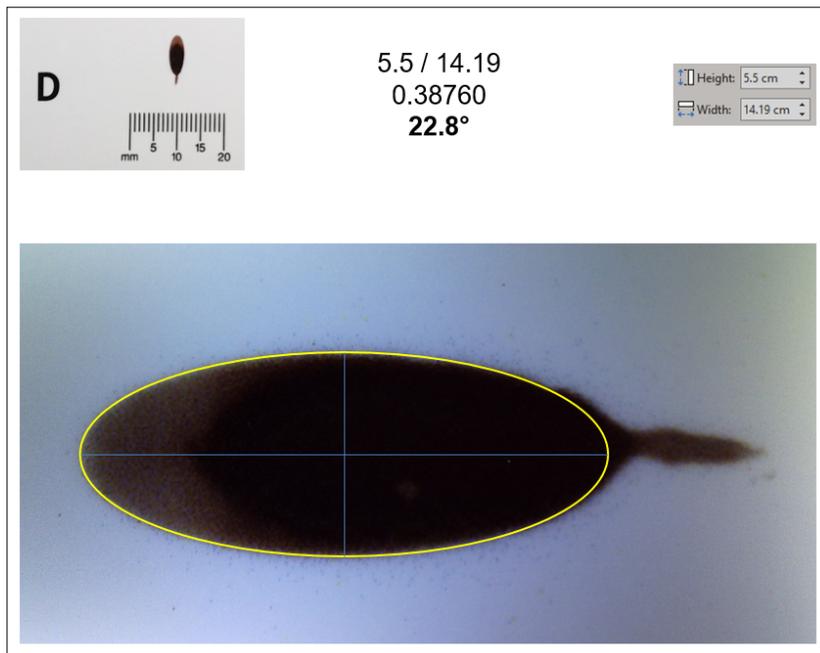
θ = Angle of impact

W = Width of stain

L = Length of stain



Digital images of individual spatter stains are used to measure each spatter stain's length and width and calculate the angle of impact. These images should be transferred to a computer and imported into a software program (e.g., PowerPoint, Adobe Photoshop, etc.) to accurately determine the ellipse and then obtain the length and width of that ellipse. The digital file containing the images of the spatter stain, ellipse and length/width measurements shall be retained in the case file for review (see example below).





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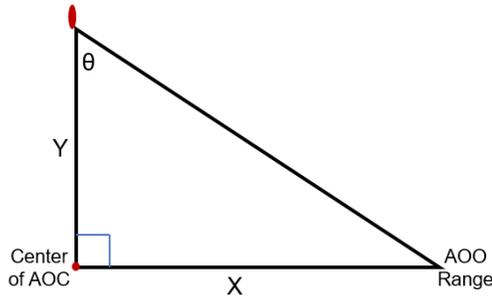
7.2.1.2 Calculating Area of Origin

$$X = \tan(\theta) \cdot Y$$

θ = Angle of impact

Y = Convergence-to-spatter stain distance

X = Convergence-to-origin distance



The convergence-to-spatter stain distance (Y) will have to be measured and input into the spreadsheet which will use this value and the angle of impact to determine the convergence-to-origin distance.

The AOO is a range and not one single distance. It shall be reported out as a range of the shortest to longest convergence-to-origin distances following the format depicted in section 9.1.3 Reporting of Measurements of this manual.

7.2.1.3 Rejected Data

Rejected spatter stain(s), angle(s) of impact and/or convergence-to-origin distance(s) shall be clearly identified and a reason for rejecting it shall be recorded in the case file.

7.2.2 Determining Approximate AOO from Two or More Adjacent AOC's

The approximate AOO can be determined in some situations utilizing AOC's on two or more adjacent surfaces from the same spatter creating event. The approximate AOO will be located at the intersection of lines extending out from the center of the AOC's. When determining the approximate AOO with this technique, it shall be properly documented and be reported as a range (based on the size of the two or more AOC's).

7.2.3 Limiting Angles

Limiting angles should only be used to determine limitations on the location of the origin of bloodstains and not specific AOO(s). When limiting angles are used for this purpose, detailed measurements of the location of the spatter stains and objects they are on should be recorded.

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8.0 Bloodstain Pattern Analysis in Laboratory Examinations

The following procedure includes laboratory analysis of items/evidence submitted to the laboratory and/or digital images of a crime scene. All applicable previous procedures in this manual may apply to laboratory examination and shall be followed.

8.1 Objective Analysis

Analysts should remain objective when conducting bloodstain pattern analysis and try to avoid extraneous influences that may cause them to subconsciously develop expectations about the outcome of an examination/analysis. Some steps that can be taken to remain objective include but are not limited to:

- Not reading external reports (e.g., police reports, medical reports, etc.) prior to analysis
- Avoiding unnecessary information or opinions from the customer prior to analysis
- Having an analyst that didn't process the crime scene perform the analysis
- Utilize the scientific method for experiments and analysis
- List characteristics of stain/pattern when documenting to determine possible mechanism(s) with those characteristics
- Utilize only facts from external reports and published literature for reference
- Be specific instead of vague or general
- Do not include what the suspect may have been thinking or actions that cannot be confirmed by the bloodstain patterns
- Be transparent about limitations that exist

Once the examination is completed and conclusions/opinions are generated, the analyst can go back and look at external reports to assist with further developing the conclusions/opinions in relation to information from the reports. The investigating officer and/or other relevant parties (e.g., assistant prosecutor) can then be contacted to determine investigative questions that can also be addressed in the conclusions/opinions.

8.2 Preparation and Planning

Review the Request for Laboratory Examination and if necessary, contact the investigating officer to obtain additional information to clarify details to assist with the examination taking into consideration remaining objective. Determine the equipment needed (including personal protective equipment) to proceed with the analysis and if other scientists/specialists will be needed for multidisciplinary consultation and collection (e.g., footwear, fingerprints, etc.).

8.3 Examination of Bloodstain Patterns on Submitted Items

The examination scheme is similar to that described previously in this manual and the Bloodstain Pattern Documentation section of the Crime Scene Procedures Manual. Items should be documented with notes, diagrams/sketches and photographs utilizing the "road mapping" technique. When examining clothing and other fabric substrates, the manufacturer information should be documented if present.

In addition to these previous examination schemes, physical items submitted to the laboratory should be examined with magnification (e.g., stereoscope, lighted magnifier, digital microscope, etc.) and bright lighting to

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assist with locating and visualizing the stains. When examining clothing and other fabric materials, all sides of the exterior and interior should be thoroughly examined and documented.

It may be necessary for clothing items to be placed on a person or mannequin to document three-dimensional aspects.

8.3.1 Examination of Bloodstain Patterns from Digital Images

The examination of digital images submitted for BPA follows a similar procedure to items with the exception of not being able to collect or test stains. The analyst should use their knowledge, skills and experience to determine what stains could be blood and if available, which stains should be tested and/or analyzed for DNA to assist with the analysis.

All digital images submitted shall be reviewed and retained in the case file. The analysis of the images shall be documented in the case file with notes and in some cases annotations on the images utilized in the BPA.

The amount of limitations usually increases with this type of analysis and should be considered and included in the report.

8.3.2 Digital Images Utilized in the BPA

Digital images captured in the lab or submitted for the analysis that are utilized in the analysis to classify pattern types and/or generate conclusions shall be included in a digital file(s) in the object repository. The images should be large enough to observe the bloodstains and characteristics utilized to classify them. Each image should be labeled minimally with the original image file name. If deemed necessary, any processing that has been done (e.g., cropped, brightened, color adjustment, etc.) can also be included in the label on the slide. The name of this digital file shall be included in the report as described in Appendix A – BPA Report Guide.

8.4 Collection and Testing of Stains on Submitted Items

8.4.1 Collection of Stains on Submitted Items

During or after the item has been examined and documented, some patterns/stains may need to be collected for chemical testing and/or DNA analysis. The selection of stains collected is left to the discretion of the analyst performing the BPA. For collection techniques, see the Biology Evidence section of the Crime Scene Procedures Manual.

8.4.2 Testing of Stains on Submitted Items

When possible and a stain is not obviously blood, at least one representative stain from any pattern should be presumptively tested or collected for testing and/or DNA analysis in the future.

8.5 Experiments

For some situations, experiment(s) may be necessary to assist with the examination and development of conclusions. When conducting experiment(s), they should follow the scientific method and shall be documented

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appropriately in the casefile and noted in the report. This documentation should include detailed notes, photographs, and in some instances, video. These experiments should be conducted with items that are similar to (e.g., fabric type/color, substrates, etc.) those involved in the case when possible.

During experimentation, the following guidelines should be considered:

- Warm the available blood to room temperature
- Perform actions which most closely reproduce the mechanism or event which you believe created the stain or pattern
- When other mechanisms or events could have created the stain or pattern, actions that would produce them should also be performed
- Prepare and perform tests including other possibilities to allow for either inclusion or exclusion in reference to an event or mechanism within reason
- Confirm the results by documenting they are reproducible

8.6 Data Collection

External information and data specific to the case may assist with the bloodstain pattern analysis and should be obtained taking into consideration remaining objective. Examples of information and data that may assist include but is not limited to:

- The location and number of scenes, scene accessibility and scene conditions (e.g., indoors or outdoors, environmental conditions, public or private)
- Persons having had access to the scene and the extent of their involvement (e.g., witnesses, first responders, medical personnel)
- Relevant reports (e.g., crime scene, biology/DNA, medical, autopsy, investigative, police)
- Relevant statements and consultations
- Notes, photographs, sketches/diagrams
- Whether other blood-shedding events are known to have occurred prior to the event in question
- Previously observed condition of bloodstains
- Number of bleeding persons, was the suspect injured, cause/manner of death or injury (location/types of wounds), possible weapon(s) used
- Blood present in the mouth or nose of bleeding persons
- Postmortem interval or time of event, if known
- Information related to seized evidence items (e.g., clothing, weapons, etc.)
- Other expert's reports/notes/statements
- Training materials
- Literature/Articles

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9.0 Reports and Release of Information

9.1 Reports

The FSD Laboratory Operations Manual has general guidelines on report writing/generation, and the FSD Quality Manual has guidelines and requirements for opinions and interpretations included in reports.

9.1.1 Elements Included in Report

In addition to the requirements in the Laboratory Operations Manual, a minimum of the following sections shall be included in a bloodstain pattern analysis report as necessary (not necessarily in this order):

- Evidence received
 - Including items created during the analysis
 - Including items received but not analyzed being marked as not analyzed
- Case information
- Supplemental reports and materials
 - Including relevant data referenced during the analysis (including MSP FSD reports)
- Assumptions and limitations
- Examination and/or observations
- Conclusions/Opinions
 - Including reason(s) for inconclusive results
- Qualifying statements and/or disclaimers
- Glossary of bloodstain pattern analysis terminology

Data that shall be included if utilized:

- Investigative questions/hypotheses
- Reference material (e.g., literature, articles, etc.)
- Experiments conducted and their results

Data that may be included but are not required:

- Methods
- Images
- Diagrams or sketches
- Information for the investigating agency
- Additional remarks

9.1.2 Required Supporting Documentation Included in the Case File

At a minimum, the following shall be included in the case file of BPA records:

- Reports utilized during the analysis
 - To include MSP FSD reports
- Digital images and photographs submitted and generated during the analysis
- Sketches/diagrams utilized and generated during the analysis
- Reference material utilized during the analysis

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9.1.3 Reporting of Measurements

Measurements included in BPA reports shall only be reported as descriptors.

For example:

- The projected pattern was 5 feet up on the south wall and 3 feet east of the edge of the bedroom window.
- The spatter stains within pattern A ranged from less than a millimeter up to 3 millimeters.
- Impact pattern S-1 originated from a source between 22 inches and 30 inches up from the floor and between 60 inches and 67 inches west of the east wall.

It is not necessary to report out measurements of individual stains and patterns because this information should be contained in the notes. The reporting of these types of measurements is left to the discretion of the analyst performing BPA.

9.1.4 Reporting of Biological Testing Performed by the Bloodstain Pattern Analyst

When including the results of biological testing of stains performed by the bloodstain pattern analyst, those results shall be specific to the individual stain tested if it is a separate from the rest of the pattern (e.g., testing performed on a single spatter stain within an impact pattern). The reporting of biological testing shall also follow the requirements found in Section 5.1 of the CSRT Procedures Manual (identity of the reagent utilized, area(s) tested and test results with what it indicates).

9.1.5 Referencing Data from Other Sources

The title or other identifier of the other source(s) of data utilized for the BPA shall be listed in the “Supplemental Reports and Material” section of the report. Examples of other sources include but are not limited to MSP FSD laboratory reports, police reports, laboratory reports, medical records and autopsy reports.

The specific data from each source that is referenced in the BPA report shall be listed under the title/identifier of the source described above in the “Supplemental Reports and Material” section of the report.

When data from other sources is referenced in the conclusions of the BPA report, it shall be identified with its source (e.g., footnote, direct reference, etc.).

Examples of all of the above can be found in Appendix A – BPA Report Template.

9.1.5.1 Referencing Biological Testing Not Performed by the Bloodstain Pattern Analyst

When referencing the results of biological testing of stains performed by someone other than the BPA report author, (e.g., testing performed by another analyst during the body fluid identification analysis or at the crime scene), those results shall be specific to the individual stain tested if it is a separate from the rest of the pattern (e.g., testing performed on a single spatter stain within an impact pattern). The statement(s) in the BPA report shall also reference the case record number from which the results of testing were performed.

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9.1.5.2 Referencing DNA Conclusions

When referencing DNA conclusions in a BPA report, the unique identifier used in the DNA report for the item and the DNA report case record number containing the conclusion(s) can be referenced. BPA Reports shall not contain DNA conclusions, statistics or associations to a person.

For example:

- A spatter stain (DNA item BP19-123- F1) from pattern F was analyzed for DNA and the results of that analysis can be found in DNA case record 5.
- DNA analysis was performed on a sample from the transfer stain (DNA item BP19-123-S1) on the south door and the results of that analysis can be found in DNA case record 3.

9.2 Technical and Administrative Review of Reports

All reports shall be technically and administratively reviewed. The FSD Laboratory Operations Manual and Quality Manual detail some requirements of these reviews in addition to those detailed below.

The technical and administrative reviews can be done by two separate analysts or combined and both reviews completed by the same analyst. The person performing the technical review shall be a fully trained bloodstain pattern analyst. Whenever possible, a fully trained bloodstain pattern analyst that was not involved with the bloodstain pattern documentation and/or analysis at the crime scene should perform the technical review.

9.2.1 Documentation of the Review

All changes/suggestions/comments from the technical/administrative review(s) shall be documented in the review comments of Forensic Advantage when the review is returned or on the technical review checklist in the object repository. If changes cannot be adequately explained in the review comments or checklist, it may be necessary to insert a copy of the report or other documents with the reviewer's comments into the object repository for the case record.

Any files related to the technical review placed in the OR by the technical reviewer should be approved by the report author.

9.2.2 Technical Review

The technical review shall include but is not limited to the review of all examination documentation within the case record and the test report to ensure:

- Conformance with proper technical procedures for BPA
- Conformance with the applicable laboratory operations and quality assurance policies and procedures
- Object repository contains the required files with the lab number in the file name and approved by the report author or the initials of the report author in the file name
- The report contains all required information including but not limited to:
 - Information from submitting agency, investigative questions and supplemental reports utilized in the analysis
 - Observations and pattern descriptions
 - Conclusions and opinions
 - Glossary

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- Disclaimers
 - Equipment/instrumentation utilized is documented in the notes and report
 - The pattern classifications and opinions/conclusions in the report are properly documented and supported in the case notes/images/documentation
 - Basis of opinions sufficiently documented in the notes
 - Directions correspond between notes, sketch and report and are the actual correct orientation
 - If testing was performed, chemicals/reagents used were documented properly in the notes (lot numbers, QA/QC, type, areas tested/processed and results) and results of testing included in the report
 - All information in the report is substantiated by supporting documentation in the case file
 - Angle calculations are correct and documented properly
 - Areas of convergence and origin are properly documented, and calculations used are correct
 - Areas of convergence and origin reported as a range
 - Measurements are reported as descriptors

9.2.3 Administrative Review

At a minimum, the administrative review shall include a review of the case submission and record to ensure:

- The test report is free of grammatical and spelling errors
- Object repository contains the required files with the lab number in the file name and approved or initialed by the author
- The request for laboratory examination for the submission is
 - Present in the submission and requests bloodstain pattern analysis
- Communication between the analyst and the agency are properly documented in the object repository

9.3 Disputed Reviews

If, during the review process, the case is returned to the analyst for either an administrative or technical issue and a resolution cannot be reached, the technical leader or designee will evaluate the disputed portion of the review and make a final determination. This evaluation and determination shall all be documented and included in the case file.

9.4 Testimony Guidelines

The following is intended to provide guidelines for FSD personnel testifying within the discipline of bloodstain pattern analysis. It does not and cannot cover every aspect of testimony that may arise. These guidelines are intended to cover testimony regardless of whether the analyst is qualified as an expert or not.

Analysts should make every effort to only testify to data and conclusions/opinions detailed in the report and case file. If the court requests additional opinions or offers their own alternate conclusions/opinions, the analyst should use their training, experience and discretion to comply with the request cautiously and appropriately. If the court requests additional/new analysis on the stand, the analyst should make every effort to explain this is not appropriate and offer that additional analysis can be performed at the lab if deemed necessary by the court.

It is recommended to utilize some type of digital file of images (e.g., PowerPoint) to support the BPA testimony being given. It is also recommended to educate the court about what BPA is, how the analysis is performed, limitations and other helpful information at the beginning of testimony.

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Analysts should not testify about details outside BPA or their other discipline(s) (e.g., lab discipline, CSRT, etc.). When testimony/questions fall outside the analyst's field(s) of expertise, they should be deferred to another expert in the field of the testimony be requested.

If other bloodstain pattern analysts (e.g., defense expert) are involved in the case, the analyst should consider examining their report and case file in preparation for court. They should also advise the prosecutor that they may want to consider having an FSD bloodstain pattern analyst present during the other expert's testimony to assist with evaluating the testimony.

9.5 Technical Review of Testimony

Whenever possible, BPA testimony should be technically reviewed and is required annually. The FSD Laboratory Operations Manual outlines the technical review of testimony in detail.

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10.0 Limitations and Assumptions

Specific limitations and assumptions that apply to an analysis shall be detailed in the report. Example statements of limitations and assumptions can be found in Appendix A – BPA Report Guide.

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