



ARKANSAS STATE CRIME LABORATORY



PHYSICAL EVIDENCE- SEROLOGY UNIT QUALITY MANUAL

Executive Director:

Kermit B. Channell, II

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SECTION 1 SCOPE

This manual follows the requirements specified by the American Society of Crime Laboratory Directors/Lab Accreditation Board (ASCLD/LAB) International Program, which utilizes the ISO/IEC 17025-2005 standards, and the 2011 ASCLD/LAB International Supplemental Requirements.

The Serology Unit Quality Manual is written specifically for the analysts working in the Serology unit and performing analyses in the following areas:

- Body Fluid Identification
- Collection of Hairs and Fibers
- Collection of Stains for Further Testing

Every case is unique and must be evaluated by the individual examiner. Not all possible analyses that may be encountered in casework can be appropriately covered in a procedures manual nor can all the possible variations be described. The quality manual is a guideline to help the analyst choose the best analytical scheme for the evidence submitted.

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SECTION 2 REFERENCES

The *ASCL Quality Manual* (ASCL-DOC-01) contains the references utilized to prepare this manual in order to meet the ASCLD/LAB International Program requirements.

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SECTION 3 TERMS AND DEFINITIONS

See *ASCL Quality Manual* (ASCL-DOC-01, Section 3) for terms and definitions that apply to all sections.

Commonly Used Abbreviations and Terms

A list of abbreviations specifically used by each analyst is maintained on the trace drive (S:) under the Abbreviations folder.

Below are some common abbreviations used in the Serology Unit:

NOVN	nothing of value noted
TL	tape lift
SASAEC	State of Arkansas Sexual Assault Evidence Collection
INC	Inconclusive

Below are some common terms used in the Serology Unit:

Sexual Assault Kit	a set of items used by medical personnel for gathering and preserving physical evidence following an allegation of sexual assault or rape
Tape Lifts	adhesive tape used to lift hairs, fibers, cellular materials, and other foreign materials from the surface of the evidence
Substrate Control	a sample collected from a non-stained area of an item of evidence
Presumptive Test	a preliminary screening test that is very sensitive, but not entirely specific to a certain body fluid
Confirmatory Test	a test that establishes the identity of a specific biological material
Sperm Cells (Spermatozoa)	reproductive cells originating from the testes of a male individual
Semen	the entire male ejaculate, including sperm cells and secretions from various glands in the male reproductive system
Blood	a specialized bodily fluid composed of plasma and cells (red blood cells containing hemoglobin, white blood cells, and platelets).

SECTION 4 MANAGEMENT REQUIREMENTS

4.1 Organization

LABORATORY ESTABLISHMENT

The Arkansas State Crime Laboratory (ASCL) was established through Act 517 of 1977. Ark. Code Ann. § 12-12-301 (West).

PERSONNEL QUALIFICATIONS, AUTHORITIES AND RESPONSIBILITIES

PHYSICAL EVIDENCE SECTION CHIEF

QUALIFICATIONS

The position requires a minimum of a Baccalaureate degree in chemistry or closely related field plus two years experience in a forensic laboratory. Other job related education and/or experience may be substituted for all or part of these basic requirements upon approval of the Scientific Operations Director. The Physical Evidence Section Chief or designee will have the appropriate technical training and experience in all disciplines encompassed by the section.

AUTHORITIES AND RESPONSIBILITIES

The Physical Evidence Section Chief is under administrative direction and is responsible for directing the activities of the Physical Evidence Section. The Physical Evidence Section Chief has overall responsibility for the technical operations and the provisions of the resources needed to ensure the required quality of laboratory operations.

The Physical Evidence Section Chief also:

- A. Supervises a professional staff of Trace Evidence Analysts and Serologists by interviewing and recommending for hire; training or providing training opportunities; assigning and reviewing work; and evaluating the performance of incumbents.
- B. Coordinates section activities by reviewing, prioritizing, and assigning new cases; providing assistance to staff in regard to appropriate testing methods and findings; and reviewing selected final reports.
- C. Reviews investigator's summary sheet to become familiar with the details of the crime, reviews items submitted to determine appropriate testing methods, and assigns cases to appropriate personnel.
- D. Conducts a series of analytical tests, prepares reports of findings and conclusions, and testifies in court as an expert witness.
- E. Writes articles, presents training, and provides consultation to law enforcement officers, prosecutors, defense attorneys, and other public officials on crime scene investigation and methods of collecting, transporting and preserving, evidence to ensure its integrity and maintenance of the chain of custody.
- F. Researches scientific literature and exchanges information with peers in other states in order to stay abreast of the latest scientific advances in the analysis of criminal evidence and/or determine the best method of testing a particular piece of evidence.

- G. Performs administrative duties by preparing activity reports, inventory reports; maintaining employee history information and equipment maintenance logs; requisitioning supplies and equipment; and researching and recommending policies/procedures.
- H. Conducts on-site crime scene investigations at the request of law enforcement agencies after gaining approval from the Executive Director or the Scientific Operations Director.
- I. Performs related responsibilities as required or assigned.
- J. May delegate duties as required.
- K. Ensure compliance with ASCLD/LAB International requirements.
- L. Appoint deputies for key management personnel when the individual will be absent for 3 days or longer. All affected personnel shall be notified.
- M. Ensure that employees are notified of their responsibilities and expectations concerning the objective of the ASCL quality system and provide feedback on actual job performance.
- N. Convey information concerning the quality system to Physical Evidence analysts.

WORKING RELATIONSHIPS

The Physical Evidence Section Chief has regular contact with other laboratory sections, law enforcement officials, attorneys, criminal/civil court personnel, and peers in other states.

SPECIAL JOB DIMENSIONS

The Physical Evidence Section Chief will experience frequent exposure to hazardous, toxic, repulsive, and/or infectious materials. Occasional in or out-of-state travel and on-call duty are required.

KNOWLEDGE, ABILITIES AND SKILLS

- A. Knowledge of the principles and practices of chemistry, chemical analysis, biology, and forensic analytical methods and techniques.
- B. Knowledge of laws, regulations, and agency policies governing trace evidence analysis.
- C. Knowledge of laboratory equipment.
- D. Ability to plan, organize, and oversee the work of subordinates.
- E. Ability to conduct and direct the activities of the Physical Evidence section.
- F. Ability to write descriptive results of analysis and appear as expert witness in court.
- G. Ability to conduct research, prepare and present training on methods of collecting and preserving evidence.

FORENSIC SEROLOGISTS

QUALIFICATIONS

The position requires a minimum of a Baccalaureate degree in biology, chemistry, or closely related field.

AUTHORITIES AND RESPONSIBILITIES

The Forensic Serologist:

- A. Reviews investigator's summary information to become familiar with the details of the crime and examines items of evidence to determine appropriate testing methods.
- B. Conducts a series of analytical tests to identify biological fluids and locate areas that may be suitable for DNA testing. Hairs and fibers (tape lifts) may be collected for future analyses.

- C. Prepares reports of findings and conclusions for submission to legal authorities and courts of law.
- D. Testifies in court as an expert witness on the analysis of evidence and conclusions reached.
- E. Writes articles, presents training, and provides consultation to law enforcement officers, prosecutors, defense attorneys, and other public officials on crime scene investigation concerning methods of collecting, transporting, and preserving evidence to ensure its integrity and maintenance of the chain of custody.
- F. Researches scientific literature and exchanges information with peers in other states in order to stay abreast of the latest scientific advances in the analysis of criminal evidence and/or determine the best method of testing a particular piece of evidence.
- G. Conducts on-site crime scene investigations at the request of law enforcement agencies after gaining approval from the Physical Evidence Section Chief.
- H. Performs related responsibilities as required or assigned.

WORKING RELATIONSHIPS

The Forensic Serologist has regular contact with other laboratory sections, law enforcement officials, attorneys, and peers in other states.

SPECIAL JOB DIMENSIONS

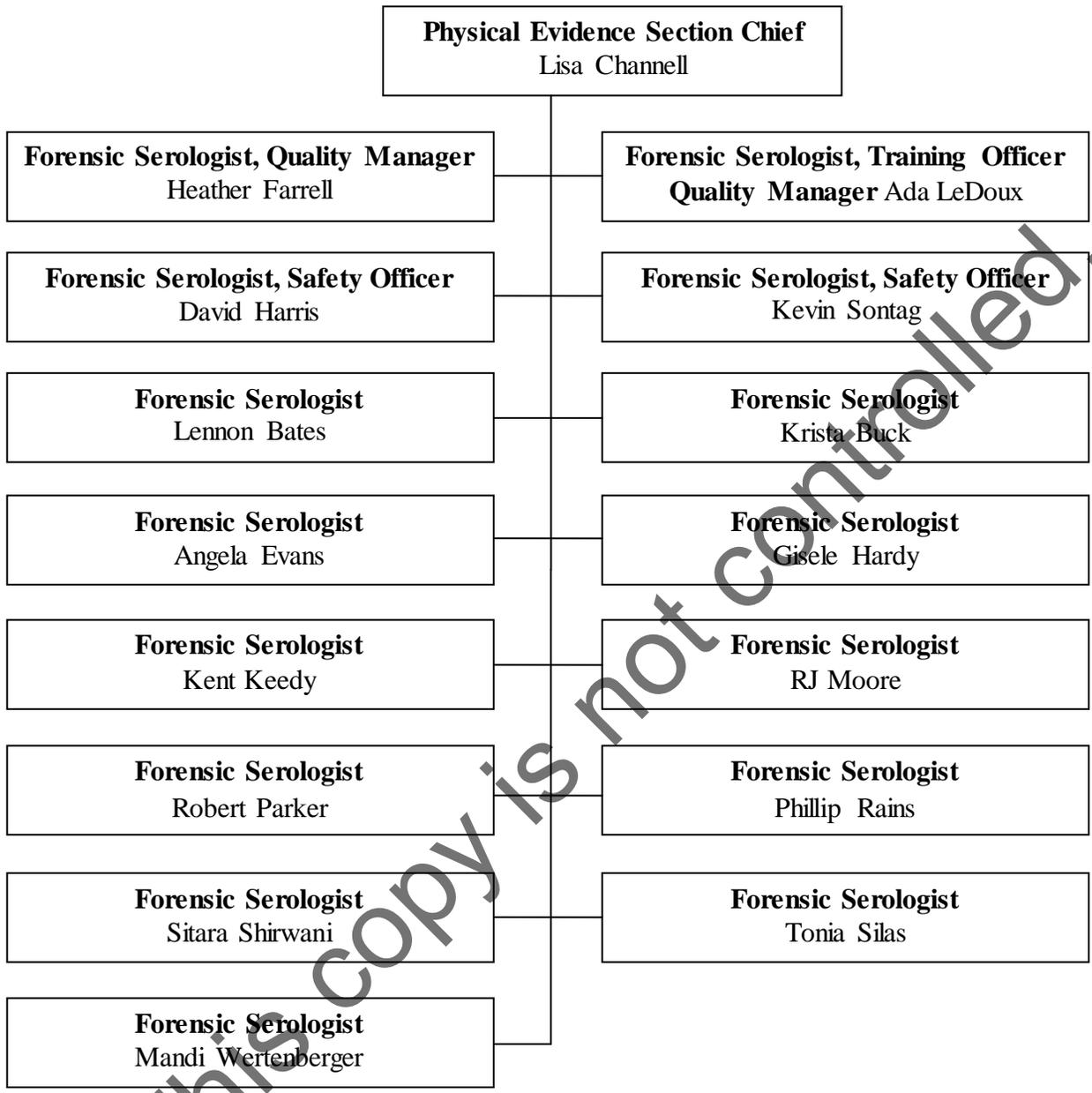
The Forensic Serologist will experience frequent exposure to hazardous, toxic, repulsive, and/or infectious materials. Occasional in or out-of-state travel and on-call duty are required.

KNOWLEDGE, ABILITIES AND SKILLS

Knowledge of the principles and practices of biology and forensic analytical methods and techniques.

- A. Knowledge of laws, regulations, and agency policies governing evidence analysis.
- B. Knowledge of laboratory equipment.
- C. Ability to assign and coordinate work.
- D. Ability to conduct forensic analysis of criminal evidence.
- E. Ability to write descriptive results of analysis and appear as expert witness in court.
- F. Ability to conduct research, prepare and present training on methods of collecting and preserving evidence.

SEROLOGY UNIT ORGANIZATIONAL CHART



Each subordinate is accountable to only one supervisor per function.

SEROLOGY UNIT QUALITY MANAGER(S)

The Serology Unit will have a Quality Manager or managers as deemed necessary by the Section Chief. The individual(s) will be responsible for ensuring that the management system related to quality is implemented and followed at all times. Other responsibilities include:

1. Maintaining and updating Serology Unit manuals and documents.
2. Monitoring section practices to verify continuing compliance with policies and procedures.
3. Maintaining and evaluating unit maintenance records and periodically assessing the adequacy of report review activities.
4. Ensuring the validation of new technical procedures.
5. Working with the lab wide Quality Manager to seek ways to improve the quality system.

SEROLOGY UNIT HEALTH AND SAFETY MANAGER(S)

The Serology Unit will have a Health and Safety Manager or managers as deemed necessary by the Section Chief for different working areas of the building. The individual(s) will be responsible for ensuring that the management system related to health and safety is implemented and followed at all times. Other responsibilities include:

1. Conducting monthly safety inspections and ensuring that proper practices and procedures are being followed within the designated area.
2. Maintaining records of any safety incidents within the designated area.
3. Maintaining a current copy of the MSDS's utilized within the designated area.
4. Working with the lab-wide Health and Safety Manager to seek ways to improve the safety program.

LABORATORY RESPONSIBILITIES

See ASCL *Quality Manual* (ASCL-DOC-01) Section 4.1.5 for the Laboratory Responsibilities.

4.2 Management System

The Forensic Serology Quality Manual establishes general guidelines for examination and testing of biological evidence, reporting of results and response to court commitments related to the evidence, as well as establishing a quality assurance program for the discipline of Serology. Serologists are responsible for familiarizing themselves and utilizing their Discipline Quality Manual. This manual is reviewed annually by the Physical Evidence Section Chief and updated as needed.

It is the objective of the Quality Assurance Program to:

1. Routinely monitor examinations and analyses of Forensic Serologists by means of quality control standards and proficiency tests.
2. Verify that all section protocols and procedures are within established performance criteria, that the quality and validity of the analytical data are maintained and that the raw data gathered provides a sound foundation for reliable conclusions.
3. Ensure that problems are noted and that corrective action is taken and documented.

The Forensic Serology Quality Manual is located on Qualtrax and is titled SER-DOC-01.

DEVIATIONS: Unforeseen circumstances may arise which require deviations from the policies and procedures of the Forensic Serology Quality Manual. In such situations, the request of exceptions to policy will be submitted in writing to the Physical Evidence Section Chief, or designee. The request must include an adequate description of the circumstances requiring the action, a statement of the proposed alternative policy and procedure, and the intended duration of the exception. The Physical Evidence Section Chief will maintain documentation of the approved policy exception.

MISSION: The mission of the Forensic Serology unit is to provide quality forensic analysis of physical evidence; produce scientific reports that are clear and accurate; provide relevant, impartial, and professional testimony in judicial proceedings; and educate the law enforcement community on crime scene investigation, evidence collection and preservation, and the forensic capabilities of the Forensic Serology unit.

Other Supporting Manuals include:

- *ASCL Personnel Handbook* (ASCL-DOC-02)—includes State, Federal, and ASCL policies.
- *ASCL Health and Safety Manual* (ASCL-DOC-08) —contains safety and environmental compliance policies and information.
- *Serology Training Manual* (SER-DOC-02).

4.3 Document Control

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Document Control.

All Serology-specific documents (i.e. Forensic Serology Quality Manual (SER-DOC-01), Training Manual (SER-DOC-02), and all worksheets) are prepared by personnel with adequate expertise in the subject. The Forensic Serology Quality Manual requires review and approval by the Physical Evidence Section Chief, lab-wide QA Manager, Scientific Operations Director, and the Executive Director. All other discipline specific documents require the review and approval of the lab-wide QA Manager and the Physical Evidence Section Chief.

All revised Serology-specific documents are reviewed and approved in the manner previously stated. See *ASCL Quality Manual* (ASCL-DOC-01) Section 4.3.3 for information regarding Document Changes.

Hard copies of all Serology documents can be printed but are considered unofficial. The official form of the Forensic Serology Quality Manual is maintained on Qualtrax.

Any external documents (i.e. reference material, computer software) will be available in the section or on the S: drive.

Documents shall be available at all locations where operations essential to the effective functioning of the laboratory are performed (i.e. annex building, crime scenes).

Employees will destroy outdated documents, in a secure manner, upon receiving updated documents. It is the employee's responsibility to verify that they are using the current revision of any document.

4.4 Review of Requests, Tenders and Contracts

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Requests, Tenders, and Contracts.

DISCUSSION OF REQUESTS

Discussions with customers (submitting agents) need to take place when information is unclear as to:

1. what type of analyses are needed
2. where or from whom the item(s) of evidence originated
3. if an arrest has been made under qualifying offenses (per current Arkansas Code)
4. request of elimination standards from involved individuals

REVIEW OF CONTRACT/ REQUEST

The Physical Evidence Section handles a large variety of cases including, but not limited to, rape, homicide, assault and battery, motor vehicle hit-and-run, property crimes, and arson. The *Case Management Guidelines* (ASCL-DOC-10) provides a general priority system for cases submitted to the Physical Evidence Section.

The Physical Evidence Section is composed of two units:

1. Serology
2. Trace Evidence

The **Serology Unit** receives evidence items associated with crimes that have been submitted to the ASCL for examination for the presence of blood, semen, saliva, and transfer or touch DNA.

The **Trace Evidence Unit** analyzes the following types of evidence: hairs, glass, paint, fibers, primer gunshot residue from suspects, physical matches, duct tape, unknown substances, headlamp filaments, and accelerants.

The Section Chief or designee will review requests as cases are assigned to the Serology Unit. Cases failing to meet the Touch DNA Policy as outlined in the *Case Management Guidelines* (ASCL-DOC-10) are placed in the RETURN file. Periodically, this file is distributed to an analyst or trainee to create a notification stating that the case will not be analyzed and the evidence will be returned. This notification undergoes a technical and administrative review.

Communications between analysts and investigating officers resulting in obtainment of new information are documented in an appropriate manner, such as an email, a conversation sheet (ASCL-FORM-06), or other appropriate document.

REQUEST FROM THE MEDICAL EXAMINER'S OFFICE

Requests originating from the Medical Examiner's office are handled exactly like request from outside agencies. Reports are written, technically reviewed, and administratively reviewed. Medical Examiner's Office requests and Agency requests may be combined into one report.

AMENDING A CONTRACT/REQUEST

If a request cannot be met, the investigating officer should be notified and documentation of the notification should be in the case file.

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4.5 Subcontracting of Tests and Calibrations

The Serology Unit does not currently subcontract any tests or calibrations.
See *ASCL Quality Manual* (ASCL-DOC-01) for general guidelines regarding subcontracting.

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4.6 Purchasing Services and Supplies

See ASCL *Quality Manual* (ASCL-DOC-01) for information regarding Purchasing Services and Supplies.

Critical supplies used by the Serology Section include:

- ABACard® HemaTrace®
- SERATEC® PSA-Semiquant

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4.7 Service to the Customer

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Service to the Customer.

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4.8 Complaints

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding External and Internal Complaints.

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4.9 Control of Nonconforming Testing

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Control of Nonconforming Testing.

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4.10 Improvement of Quality System

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Improvement of Quality System.

The Serology Unit identifies opportunities for improvement through various sources, including:

- employee suggestions,
- internal and external audits, and
- customer surveys.

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4.11 Corrective Action

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Corrective Action.

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4.12 Preventative Action

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Preventative Action.

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4.13 Control of Records

RECORD STORAGE AND RETENTION

Historical non-electronic case files for Serology are stored within the section; in the file room in the main building; in the evidence storage area in Evidence Receiving; in the file rooms located in the annex; or at the off-site storage facility.

Quality records, such as reagent and chemical QC logs, are stored in the Serology section, and are accessible to all Physical Evidence employees.

Quality records, such as training records, are stored in the Serology section, and are accessible to the Section Chief and designee.

DATA RECORDING

Observations, test results, and other data are recorded at the time they are made and shall be identifiable to the specific task.

RECORDING OF DATES OF ANALYSES

The date the case is started shall be recorded in the notes or on the case worksheet. Dates of analysis are documented in the notes. The ending date for work is considered the date recorded in JusticeTrax as "Draft Complete."

DOCUMENTATION OF CORRECTIONS

Any corrections will be made by an initialed, single strikeout of the text (the stricken text must still be legible) by the person making the change. Use of correction fluid or correction tape is prohibited.

EXAMINATION RECORDS

Examination records are any records generated by the analyst/examiner for a case file (e.g. notes, worksheets, photographs, and other data). Examination records that are essential for the evaluation and interpretation of the data must be stored in the appropriate folder within the 'Request' folder in the LIMS case file.

All other records contained in the case file will be considered administrative records and will be stored in the 'Case Images' folder in the LIMS case file.

- All examination records generated in association with a case are stored in the appropriate Request folder, i.e. Serology, Supplemental Serology, in the LIMS case file.
- Conversation records, including emails, should be stored in the Case Images folder and in the appropriate Serology Request folder in the LIMS case file.
- Case Review forms are stored in the Case Images folder in the LIMS case file.

EXAMINATION RECORD DOCUMENTATION

The unique Arkansas State Crime Laboratory case number (YYYY-000000) (handwritten or electronically generated) **and** the analyst's handwritten initials or secure electronic equivalent of initials or signature must be on all examination records in the case file.

RECORD PREPARATION

When an individual other than the issuing examiner prepares examination records, the initials of that individual(s) shall be on the page(s) of examination records representing their work. It should be clear from the case record which analyst performed all stages of the examination/analysis.

ADMINISTRATIVE RECORD DOCUMENTATION

The unique Arkansas State Crime Laboratory (ASCL) case number (YYYY-000000) (handwritten or electronically generated) must be on all administrative records in the case file.

PERMANENCY OF EXAMINATION RECORDS

Handwritten notes and observations must be in ink; however, pencil may be appropriate for diagrams or making tracings. Nothing in the handwritten information shall be obliterated or erased.

DOCUMENTING VERIFICATIONS

Verification is an independent examination of the evidence by another competent analyst to confirm the primary analyst's conclusions. Verifications shall be performed by another analyst qualified in the same discipline/sub-discipline. Verifications must be documented in the case file indicating that the critical finding has been verified and agreed to, by whom, and when the verification was performed.

If the individual confirming the result draws the same conclusion as the primary analyst, documentation shall be clear as to what was verified, who performed the verification, and the date the verification was performed. If the individual draws a different conclusion from the primary analyst, the issue shall be brought to the attention of the Section Chief for resolution. The final conclusion shall be verified and documented as described above.

Identification of spermatozoa cells shall be verified by another qualified analyst. If the confirming analyst draws the same conclusion as the primary analyst, documentation will be made on the worksheet with the initials of the confirming analyst. If the verification is conducted on a date different from the date at the top of the worksheet, the confirming analyst will document the date near their initials.

ABBREVIATIONS

Abbreviations may be used in examination records. An abbreviation legend for each analyst is located on the S-drive (TRACE drive) and is accessible to all reviewers.

4.14 Internal Audits

The Serology Unit complies with the lab-wide policy regarding internal audits.

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Internal Audits.

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4.15 Management Reviews

The Physical Evidence Serology Unit complies with the lab-wide policy regarding management reviews.

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Management Reviews.

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SECTION 5 TECHNICAL REQUIREMENTS

5.1 General

REAGENTS/CHEMICALS/CONTROLS

Reagents, chemicals, and controls utilized by the Serology Unit are maintained and quality controlled.

In addition, the following rules shall be followed:

- Items with a manufacturer-specified expiration date may not be used after that date without documentation to support continued reliability.
- For items without a manufacturer-specified expiration date, dates will be based on experience, industry standard, or scientific consensus.
- Appropriate logs must be maintained within each discipline for reagents and standards used.
- Each analyst must ensure that the controls, reagents, and chemicals used in their analysis are of satisfactory quality.
- Controls, reagents, or chemicals that are determined not to be reliable must be immediately removed from use.
- Directions for the preparation of commonly used reagents are found in the Reagent Logbook located in Room 315 (large Serology Room).

DOCUMENTATION AND LABELING

Reagents may be purchased or prepared. Minimum requirements for quality control of reagents are outlined below.

PURCHASED REAGENTS/CHEMICALS

Containers must be labeled with the following:

- Lot number
- Date opened
- Expiration date (if applicable)
- Initials upon opening
- Date received and initials

PREPARED REAGENTS

Containers must be labeled with the following:

- Identity of reagent
- Date of preparation
- Date of expiration
- Initials of preparer
- Lot number—Takayama ONLY

PREPARED REAGENTS

Logbook must include the following:

- Identity of reagent
- Date of preparation
- Date of expiration
- Instructions on preparation of reagent
- Lot numbers of solvents and/or chemicals used in preparation of reagent
- A method to verify the reagent's reliability *
- Initials of the person preparing reagent
- Initials of the person verifying reagent (if applicable)
- Date reagent in use

*The reliability testing shall occur before use or, if appropriate, concurrent with the test.

CONTROLS

Specifications of appropriate controls are discussed in Serology Testing Procedures, Section 5.4.

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5.2 Personnel

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Personnel.

TRAINING PROGRAM

The Serology Unit training program requires analysts-in-training to work with qualified analysts on a daily basis for a minimum of three months with the average time being six to eight months. Additional time may be required of specific employees.

Serologists-in-training will begin by observing casework with a qualified analyst. The serologist will be instructed in the following areas during his or her training:

1. Evidence assessment
2. Hair and fiber collection
3. Alternate light source (ALS) use
4. Stain collection
5. Collection of samples for transfer
6. Blood examination
7. Semen examination
8. Report writing

The serologist-in-training will be instructed in the following components of evidence assessment:

1. Assessment of the information provided by the customer;
2. Assessment of the evidence submitted for examination in light of the information provided;
3. Determining whether the evidence submitted may have probative value for testing by other sections; and
4. Ensuring the integrity of evidence for testing by other sections such as, but not limited to, Latent Prints, Trace, and Firearms.

Serologists-in-training will be evaluated through observation, practice testing, and verbal questioning by the training officer, other analysts, and the Physical Evidence Section Chief.

The *Serology Training Manual* (SER-DOC-02) states objectives, specific reading requirements, tasks, and practical exercises for analysts to complete during the training period.

Upon completion of the training program, the serologist-in-training will demonstrate his or her competency in Serology by completing the following tasks:

1. Take a written exam to demonstrate his or her knowledge of proper evidence handling, serological testing, and the analytical procedures used in serological testing.
2. Perform an examination of unknown samples, which are representative of evidence encountered in casework, to demonstrate his or her proficiency in the following areas:
 - a. Evidence assessment,
 - b. Hair and fiber collection,
 - c. ALS use,
 - d. Stain collection,

- e. Collection of samples for transfer,
 - f. Blood examination,
 - g. Semen examination, and
 - h. Report writing.
3. Participate in moot court proceedings.

See the *Serology Training Manual* (SER-DOC-02) and the *ASCL Quality Manual* (ASCL-DOC-01) for further details of the training program.

MOOT COURT

Serologists-in-training participate in, at minimum, one moot court situation. Additional moot court experiences are conducted when deemed necessary by the Physical Evidence Section Chief.

ADDITIONAL TRAINING

The training program shall include the application of ethical practices in forensic science, a general knowledge of forensic science, and applicable criminal and civil law procedures.

JOB DESCRIPTIONS

Current job descriptions for court-qualified analysts shall be maintained in their respective Employee History Binders.

EMPLOYEE DEVELOPMENT PROGRAM

Serologists attend training annually. This training may include professional meetings, staff development seminars, technical training courses, in-house technical meetings, courses and seminars, or ASCL sponsored seminars and conferences. Training shall be documented in the individual's Employee History Binder.

AUTHORIZATION DOCUMENTATION

The Physical Evidence Section Chief will authorize personnel to sample evidence, analyze evidence, issue reports of analysis, and operate equipment within the section. Authorization documentation shall be part of the competency documentation (see 5.2.1) and shall be dated and signed by the Physical Evidence Section Chief upon completion of training and is maintained in the Employee History Binder. Each Employee's History Binder shall also contain a curriculum vitae or resume that includes educational and professional qualifications, training, skills, and experience. The individual's Training Binder will contain all completed training records.

TECHNICAL PERSONNEL QUALIFICATIONS

Analysts working in the Serology Unit shall possess a baccalaureate or an advanced degree in a natural science or a closely related field.

COMPETENCY TESTING

All serologists shall satisfactorily complete a competency test (examination of unknown sample(s)) in each category of testing in which they intend to perform casework.

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Competency Testing.

LITERATURE

Analysts and trainees are encouraged to read current literature regularly; a Literature Log is located on the S-drive for analysts and trainees to document their survey of forensic literature.

This copy is not controlled.

5.3 Accommodation and Environmental Conditions

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding Accommodation and Environmental Conditions.

Temperature can affect the quality of results when using reagents for particular procedures in the Serology Unit and hence these reagents must be refrigerated when not in use. When reagents need to be refrigerated, the temperature of the refrigeration unit will be monitored, controlled, and recorded. Refer to Table 6 in this manual.

LABORATORY SEPARATION

The Serology Unit contains multiple work areas, i.e. separate scrape-down rooms, additional work areas, for the examination of evidence. Victim clothing, suspect clothing, and other items shall be examined in separate work areas as deemed necessary.

ACCESS/SECURITY

The Serology Unit is secured by lockable doors. Key/Fob card access is issued only to analysts within the Physical Evidence Section, the DNA Section, the CODIS Section, and Administration. Each analyst has a set of lockable drawers and cabinets; keys to these drawers are issued only to the analyst and the Chief Criminalist. The scrape-down rooms are secured by lockable doors; only analysts in the Physical Evidence Section and Administration have access to these rooms.

A locked key box is located within the section and the Chief Criminalist and the Quality Manager(s) have access to the key box. A key log is maintained by the Quality Manager(s) on the S-drive.

HEALTH AND SAFETY PROGRAM

See *ASCL Quality Manual* (ASCL-DOC-01) for general information regarding the Health and Safety Program.

5.4 Test Methods and Method Validation

The Serology Unit uses appropriate methods for all testing and evidence handling. The following methods encompass the most commonly encountered evidence types and are intended to serve as guidelines to analysts. Analysts have discretion in choosing appropriate procedure(s) for a particular piece of evidence.

CONTAMINATION PREVENTION PROCEDURES

1. Approved Cleaning Supplies: Bleach-Rite[®] (contains at least a 1:10 dilution of NaOCl, bleach; 0.55% by weight), Clorox[®] Germicidal Wipes (0.55% NaOCl), or a 10% solution of bleach may be used to clean laboratory surfaces for contamination prevention.
2. Examination areas and tools, such as forceps and scissors, shall be cleaned prior to evidence examination, at minimum, but may be cleaned more frequently as necessitated by the instant case under examination.
3. Serologists shall wear disposable gloves, a laboratory coat/apron, and a facemask during the examination of evidence and collection of biological stains, hairs, and fibers.
4. Serologists shall remove disposable gloves prior to handling or using those areas designated as "CLEAN" in the laboratory. Labels designating certain items as clean have been placed on areas, door handles, and items that are considered clean meaning that gloves should *not* be worn when handling these items. Alternately, "BIOHAZARD" labels have been placed on those items that are *not* clean meaning that gloves shall be worn when handling items or using areas labeled as biohazard.
 - Clean items include, but are not limited to, the following:
 - FD Secure Storage Cabinet
 - PE Secure Storage Cabinet
 - ALL supply cabinets and drawers
 - Copier and Printers
 - Notebooks/Logbooks
 - Biohazard items include, but are not limited to, the following:
 - Water baths
 - Ovens
 - Slide warmers
 - ALS devices
 - Refrigerators
 - Centrifuges
 - Glass waste containers
 - Biohazard container
 - Sharps container

5. Clean swabs, test tubes, disposable pipettes, slides, etc. are stored in the working areas such that no contact between those items and evidence will occur.
6. Any person coming within close proximity of a serologist's bench top while the serologist has evidence on the bench top shall wear disposable gloves, a laboratory coat, and a facemask.
7. Prior to, during, and/or after evidence preservation and testing processes, change gloves and wipe off examination/work areas (i.e. countertops, drawer handles, cabinets), tools (i.e. tweezers, scissors, pipettes), and tube racks with approved cleaning supplies (see #1 above).

GUIDELINES FOR SCREENING FOR BIOLOGICAL STAINS

1. Review the summary provided on the submission sheet. Review officer's report (if submitted) and speak with the detective or attorney if necessary.
2. Cover work surface with clean exam paper prior to examining evidence.
3. Clean scissors and tweezers/forceps with 10% bleach then rinse with water.
4. Document and label all packaging.
5. Open package without destroying other seals and initials when possible.
6. Describe item in case notes.
7. Determine whether trace evidence materials need to be collected. These may include gunshot residue (GSR), glass, paint, hairs, or other trace materials. If deemed necessary, collect trace evidence prior to conducting biological stain examinations.
8. Diagram or photograph item if helpful in creating a record of evidence. An infrared camera may be used to photograph evidence. Infrared photography is best suited for photographing stains on dark colored fabric or clothing. Ideal light sources for infrared photography are: sunlight through a window, the camera flash, and incandescent light. Photography under fluorescent light alone is not suggested, because there is a low amount of infrared light emitted. After a photograph is taken, its appearance may be enhanced by converting the color scheme to grayscale on a computer. If the fabric type is suitable for infrared photography, the fabric should appear to be light gray while the stains remain dark gray.
9. Visually examine the item for possible biological material. An alternate light source (ALS) may be used when no visible seminal stains are noted. Chemically test (phenolphthalein and/or AP) any stains of interest. Document results in case notes.
10. Evaluate each possible biological stain to determine the appropriate amount to be consumed in testing. Conserving material for future testing is a priority.
11. When appropriate, the approximate sizes of bloodstains and semen stains should be documented in the case notes. Bloodstains can be described according to size, directionality, surface of origin (inside or outside a garment), etc.

TEST METHODS

I. Collection of Hairs and Fibers

- A. **Scope:** Hairs and fibers should be collected when deemed necessary by the Serologist after consideration of information presented in the case. The investigating officer and/or the Trace Evidence analyst may be consulted. This is a collection phase only—microscopic

analysis may be conducted by a qualified analyst at another juncture. If tape lifts are taken, they may be used later for hair analysis, fiber analysis or DNA (transfer) analysis.

B. Evidence Assessment by Analyst

1. Determine which items are from the victim, suspect, scene, etc.
2. Hairs and fibers should not be collected on items where the victim and suspect are co-habiting. It may be necessary to examine some items (i.e. murder weapon) for a transfer of hairs and/or fibers.

C. Testing Techniques

1. *Collection from Sexual Assault Kits*

- (a) Examine contents of sexual assault kit to locate the "Pubic Hair Combing" envelope and "Underwear" bag. Note any extra items that may have been included for hair and fiber examination.
- (b) If samples were not collected according to the information supplied on the package, no further analysis is needed for that item. Record in notes.
- (c) Open the "Pubic Hair Combing" envelope and remove all hairs from the comb, cotton, and/or napkin. Place the hairs in a folded piece of paper or tissue and package in a labeled coin envelope. Return the "Pubic Hair Combing" envelope to the kit.
- (d) Place envelopes and/or tape lift transparency sheets in a manila envelope and label accordingly.

2. *Collection from Clothing or Other Items*

- (a) Visually examine item and note description of item and fabric content, if applicable.
- (b) Take care to preserve evidence that other sections may need to examine, i.e. blood stains, latent prints, etc. It may be necessary to collect fibers and/or hairs with forceps and place in an envelope or on tape rather than tape lifting the item directly.
- (c) Tape lifting is accomplished by taking a section of clear adhesive tape and pressing on the item and pulling away. Fibers and/or hairs adhere to the tape, which is then placed on a clear transparency sheet. Continue collecting with sections of tape until the entire item has been covered.
- (d) Label the tape lifts on the transparency sheet.
- (e) Known samples of all the fiber types and colors are cut from the item and are either placed on a transparency sheet with clear tape or placed in an envelope. White cotton, denim, light-colored fabrics, and smooth fabrics (such as nylon windbreakers) are not suitable target fibers.
- (f) Place envelopes and/or tape lift transparency sheets in a manila envelope. Label envelope with the ASCL case number, evidence number, description of retained evidence, analyst's initials, Agency & case number, and offense.

D. *Notes/Documentation*

1. Describe packaging and evidence in notes.
2. Photographs or photocopies of the items and/or packaging may be taken.
3. Describe evidence items in notes; include fabric content if applicable.

E. *Assessment of Results*

1. Review evidence collected.
2. If known hair/fiber samples have been submitted and/or additional work needs to be completed, send to the appropriate analysis section or turn the case over to the section supervisor for reassignment.
3. If known samples were not submitted, write report requesting known samples, if needed.

F. *Report Writing Suggestions*

1. Tape lifts were collected from the items listed; they are being retained.
2. Hairs and/or fibers were collected from the items listed; they are being retained.

II. **Collection of Stains for Further Testing**

A. **Scope:** Stains should be collected when deemed necessary by the Serologist after consideration of information presented in the case. The investigating officer may be consulted. This is a collection phase only.

B. **Evidence Assessment by Analyst:** There are three methods of collecting stains, potential DNA, from a substrate: cutting, swabbing, and tape lifts.

C. **Method**

1. *Collection by Cutting*

Cutting is useful for porous substances such as clothing, paper, upholstery, etc.

(a) Use clean tools (i.e. scissors, razor, etc.) according to Section 5.4. Disposable sterile surgical blades may also be used.

(b) Cut the stain from the whole substrate.

(1) Small stains: Cut the entire stain.

(2) Large stains: Cut a portion(s) of the whole stain taking a representative sample.

(3) Semen stains: Cut semen stains where the highest concentration of spermatozoa may be located; use alternate light source to aid in stain collection if necessary.

(c) Place cutting into a clean envelope (coin envelope, #1). Small cuttings may first be placed into a paper-fold and then into the clean envelope. Other appropriate packaging may also be used.

(d) Label the exterior front of the envelope with the following information:

(1) Arkansas State Crime Laboratory Case Number

(2) Evidence Number

(3) Description of Retained Evidence

ASCL Case Number (YYYY-000000)
Q# Description of Retained Evidence (i.e. Swab of item, Cutting of item)
Analyst Initials

- (4) Analyst Initials
- (e) Initial the tape seal on envelope
2. *Collection by Swabbing*
- Swabbing is useful for non-porous substrates such as cans, plastics, glass, vinyl, etc.
- (a) Moisten a sterile swab with deionized water.
- (b) Rub the stain with the swab until the stain is completely collected or the swab is saturated thoroughly with the stain. Repeat steps 1 and 2 until enough of the stain has been collected.
- (c) Allow swab(s) to air dry.
- (d) Place swab(s) into a clean envelope (coin envelope, #1). Other appropriate packaging may also be used.
- (e) Label the exterior front of the envelope with the following information:
- (1) Arkansas State Crime Laboratory Case Number
- (2) Evidence Number
- (3) Description of Retained Evidence
- (4) Analyst Initials
- (f) Initial the tape seal on envelope
3. *Collection by Swabbing–Double Swab Technique*
- This technique may be used in collection of saliva from cans and bottles or whenever deemed necessary by the analyst.
- (a) Moisten a single swab with deionized water.
- (b) Thoroughly swab, with pressure, all the areas the mouth would have touched.
- (c) While surface is still damp thoroughly re-swab, again with pressure, the same areas with a dry swab.
- (d) Label the swabs directly or with tape and allow to air dry.
- (e) Place swab(s) into a clean envelope (coin envelope, #1). Other appropriate packaging may also be used.
- (f) Label the exterior front of the envelope with the following information:
- (1) Arkansas State Crime Laboratory Case Number
- (2) Evidence Number
- (3) Description of Retained Evidence
- (4) Analyst Initials
- (g) Initial tape seal on envelope
4. *Collection by Tape Lifts*
- This technique may be used when collecting epithelial cells from porous surfaces such as clothing, bedding, upholstery, etc.
- (a) Obtain a section of clear packaging tape approximately 3–4 inches in length and fold over a portion of tape to assist in removal.

ASCL Case Number (YYYY-000000)
Q# Description of Retained Evidence (i.e.
Swab of item, Cutting of item)
Analyst Initials

- (b) Apply the tape to the section to be sampled using slight pressure and then pull away. Continue to apply tape and pull away from substrate until the area to be sampled has been covered.
- (c) Place tape section onto clear acetate and label with the following information:
 - (1) Arkansas State Crime Laboratory Case Number
 - (2) Evidence Number
 - (3) Description of Evidence
- (d) Place tape lifts into a clean envelope.
- (e) Label the exterior front of the envelope with the following information:
 - (1) Arkansas State Crime Laboratory Case Number
 - (2) Evidence Number
 - (3) Description of Retained Evidence
 - (4) Analyst Initials
 - (5) Agency & case number
 - (6) Offense
- (f) Initial seal on envelope

ASCL Case Number (YYYY-000000) Q# Description of Retained Evidence (i.e. Swab of item, Cutting of item) Analyst Initials

D. Notes/Documentation

- 1. Describe packaging and evidence in notes.
- 2. Photographs, drawings, or photocopies of the items and packaging may be taken.
- 3. Describe evidence items in notes; include size and location of stain, when applicable.
- 4. Describe how stain was collected in notes, i.e. retained cutting, retained swab, retained tape lifts.

E. Assessment of Results

- 1. Review evidence collected.
- 2. If additional work needs to be completed, submit to the appropriate analysis section.

F. Report Writing Suggestions: In order to complete additional testing, known oral swabs are needed from _____.

III. Visual Examination

A. Scope: A visual examination of evidence is used to identify stains that are characteristic of blood and/or semen.

B. Method: Visually examine the item of evidence for stains characteristic of biological material. In addition to locating stains visually, an alternate light source (ALS) may be used. See Section IV Alternate Light Source (ALS) Examination.

If a visual examination reveals stains characteristic of biological material, then proceed to the appropriate presumptive and confirmatory testing procedures for the located stains.

C. Notes/Documentation

- 1. *Visual Examination for Blood:* If no stains are located by visual examination of the item, then document in a way indicating that no stains were located by visual examination that warranted further testing for the presence of blood.

2. *Visual Examination for Semen:* If no stains are located by visual examination of the item, then the item should be examined using the ALS. See Section IV Alternate Light Source (ALS) Examination. If no stains are located by either visual examination or by visual examination with ALS, then document in a way indicating that no stains were located by visual examination that warranted further testing for the presence of semen.

D. Assessment of Results and Report Writing Suggestions

1. *Blood*

An item that has been visually examined and determined not to have any stains of probative value for testing may be reported as, 'A "no visual stains" result signifies that no stains characteristic of blood were identified by visual examination.'

2. *Semen*

An item that has been visually examined, with and without the ALS, and determined not to have any stains of probative value for testing may be reported as, 'A "no visual/ALS stains" result signifies that no stains characteristic of semen were identified by visual or alternate light source (ALS) examination.'

IV. Alternate Light Source (ALS) Examination

A. Scope: The alternate light source (e.g. Omni Print 1000 and Crime-Lite) is a tool used to collect trace evidence and make possible semen stains, saliva stains, urine stains, and other body fluids on physical evidence visible. It should not be considered an alternative to chemical tests.

B. Evidence Assessment by Analyst: Visually examine the item for possible biological material. The alternate light source (ALS) may be used when no visible seminal stains are noted.

C. Method : Seminal fluid, Saliva, Sweat, Urine : These stains may fluoresce with the following combination of glasses and wavelengths :

450 nm – yellow (amber) glasses (seminal stains)

530 nm – red or orange glasses

485 nm – red or orange glasses

1. When in the laboratory, the alternate light source shall be used in a dark environment to best illuminate possible stains. If outside of the laboratory and examination environment is not conducive to dark lighting, analyst may use their discretion to determine appropriate lighting when using the ALS.
2. Systematically scan the light over the evidence looking for stains or other evidence that may be of forensic value. Some stains may require using the ALS at various angles to visualize. For example, some stains may be illuminated when using the light 12 inches away at a 90 degree angle, where as some may require an oblique angle at 1-2 inches away.
3. Circle or otherwise mark areas that fluoresce without marking on the stain so they may be located in normal lighting conditions for testing.

4. If no stains of interest are visible with the alternate light source, additional search methods (such as targeted swabbing, quadrant swabbing, regularly spaced cuttings) in conjunction with the appropriate testing methods (e.g. phenolphthalein, AP testing, etc.) may be required for a thorough examination depending on the evidence, case, and other factors as determined by the analyst.

D. Notes/Documentation

Document in notes when the alternate light source is used to examine an item of evidence.

E. Assessment of Results

1. If the alternate light source is used to identify possible semen stains, those stains are then tested to determine whether semen is present.
2. If the alternate light source is used to identify areas with possible saliva, sweat, or urine then those stains are not tested for semen, but are retained.

F. Cautions

1. Semen stains will not always fluoresce; lack of fluorescence does not mean semen is not present as blood/semen mixtures may not fluoresce.
2. Other non-biological stains such as beverages, food products, and detergents may fluoresce in a similar manner as body fluids and it may be difficult to distinguish stains of forensic interest from background fluorescence.
3. Never look directly into the light or allow beams to bounce off surfaces into your eyes or the eyes of other persons in the vicinity. Goggles should be worn to view evidence when using the alternate light source.

V. BCIP: bromo-chloro-indolyl phosphate (BCIP) Test for the Presumptive Screening of Suspected Seminal Stains

A. ***Scope:*** Seminal acid phosphatase is detected in stains of seminal origin through its hydrolysis of the BCIP substrate to an insoluble stable blue product.

B. Method

1. Sample a questioned stain by rubbing with a cotton-tipped applicator moistened with distilled water. Place in a labeled test tube.
2. Once all swabs are collected, add adequate BCIP reagent to each tube to cover the tip of the swabs, and incubate in water-bath at an approximate temperature of 37° +/- 5°C for 15 minutes.
3. Required Controls (with each run) :
 - (a) **Control A:** Reagent blank - a sterile swab is placed directly in a labeled tube.
 - (b) **Control B:** Positive control - a moistened swab applied to a known semen stain and placed directly in a labeled tube.
 - (c) **Substrate Control:** a moistened swab is applied to an unstained area on the questioned item and placed directly in a labeled tube.

4. After incubation, acid phosphatase activity is indicated by the development of a blue to aqua-blue color on the swabs.

C. Interpretation of Results

1. No color change indicates the absence of acid phosphatase and is recorded as a negative (-) result.
2. The blue/aqua-blue BCIP hydrolysis product is indicative of acid phosphatase activity and is recorded as a positive (+) result.

D. Notes/Documentation

1. The results obtained from testing of questioned stains and substrate controls are recorded in the notes.
2. The results of the positive and negative controls are recorded in the notes.
3. The analyst will check the temperature of the water bath at each use to verify that the temperature is within the specified temperature range of 37°C +/- 5°C. This pass/fail verification is recorded in the notes.

E. Assessment of Results

1. Positive Result: Proceed to confirmatory testing procedures for semen.

Note: It is not always necessary to perform confirmatory testing on all positive BCIP stains on an item. The analyst will use his or her own judgment and experience to determine when further testing is not necessary. For example, if a flat sheet has ten stains with positive BCIP results and the analyst has identified sperm cells or p30 on one or more of those stains, then the analyst may describe and retain the remaining BCIP positive stains without performing confirmatory tests for semen.

2. Negative Result: No further testing is required.

F. Report Writing Suggestions

1. **Positive:** DO NOT REPORT- Proceed to confirmatory testing.
2. **Negative:** A "-" result signifies that no semen was chemically identified.

G. Troubleshooting

1. **Control A**, reagent blank, produces a positive result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - a) Obtain a new reagent blank and retest all samples.
 - (1) If testing of new reagent blank yields negative results, discard previous (old) reagent blank and record findings.
 - (b) If testing of new reagent blank yields positive results then make new BCIP reagent.
 - (1) Verify BCIP reagent by retesting old and new reagent blanks along with a positive control and recording in the Reagent Logbook.
 - (2) If testing of reagent blanks yield negative results then discard old BCIP reagent and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.

2. **Control B**, positive control, produces a negative result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Obtain a new positive control and retest all samples.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (b) If testing of new positive control yields negative results then make new BCIP reagent.
 - (1) Verify BCIP reagent by retesting old and new positive controls along with a reagent blank and recording in the Reagent Logbook.
 - (2) If testing of positive control yield positive results then discard old BCIP reagent and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
3. **Substrate control** produces a positive result.
 - (a) Retest by selecting a different area to use as the substrate control.
 - (1) If negative, record all test results in notes, use the tested area with negative results as the substrate control site, and retain as necessary.
 - (2) If positive, record all test results in notes, select either tested area to use as the substrate control, and retain as necessary.
 - (b) If there is no other suitable area to test for a control, record test results in notes and retain as necessary.
4. Saturated swabs saturate the questioned stain not allowing for adequate transfer of sample for testing.
5. Inadequate pressure during sample collection will result in insufficient sample being transferred to the swab.
6. Degradation of sample can occur when test swabs are allowed to stand too long following stain sampling but prior to reagent addition. A maximum of two hours is allowable between test swab collection and reagent addition.

VI. Extraction of Suspected Semen Stains for Analysis of Soluble and Particulate Seminal Components

- A. **Scope:** Sperm cells and/or p30 are accepted markers for detecting semen; detection is accomplished through microscopic and chemical examination of the extract.
- B. **Method:** The following procedure will provide an extract of the soluble substances and a pellet of the particulate material for analysis.
 1. Place cuttings of questioned stain (approximately 3–7mm² for cloth; approximately ¼ to ⅓ of cotton-tipped applicator) into 1.5ml polypropylene centrifuge tube. Adjust cutting size according to thickness of material and size of stain.

2. Add approximately 250 μ l (8 drops) of HEPES buffer to each sample and allow two hours for extraction at room temperature with occasional agitation. Extraction may also be accomplished overnight under refrigeration.
3. Centrifuge to maximize recovery of extract and pellet.
 - (a) Perforate the centrifuge tube top using a dissecting probe or similar tool.
 - (b) Agitate the cutting, remove cutting from tube, and place on top of centrifuge tube. This allows as much fluid as possible to be extracted from the sample.
 - (c) Centrifuge approximately three minutes.
 - (d) The 1.5ml tube now contains the supernatant, which is ready for SERATEC® PSA Semiquant testing, and a pellet or particulate material, which may contain sperm cells.
 - (e) Note: If the test cannot be run immediately, the tube may be refrigerated or frozen overnight.

C. *Preparation of Slide from Pellet*

1. Separate pellet from supernatant.
2. Lightly break up pellet with dropper, take up a portion of pellet material, and deposit on microscope slide.
3. Dry slide in oven and proceed with Christmas Tree staining procedure.

VII. **Christmas Tree Stain for Identification of Spermatozoa**

A. **Scope:** The Christmas Tree staining method is the most reliable microscopic visual confirmation for the presence of sperm cells. The Picroindigocarmine (PICS) stains the tail portion of the sperm cell green, and the Nuclear Fast Red stains the head of the sperm cell red.

B. **Staining Procedure**

1. Dry slide in oven.
2. Cover stain in 100% Ethanol and allow to dry in oven.
3. Add a few drops of Nuclear Fast Red stain to slide. Allow to sit approximately 15–20 minutes.
4. GENTLY wash off stain with distilled water.
5. Dry slide in oven.
6. Add PICS stain and then rinse with 100% Ethanol after approximately 15 seconds.
7. Dry slide in oven.
8. Examine slides using microscope.
9. Use Permout as needed.

Note about Permout: Permout is stamped with an expiration date by the manufacturer; however, this mounting medium may be used past the expiration date as long as it is checked to ensure proper quality. A successful QC performance check

extends the expiration date 1 year. This QC performance check is recorded on the Permout QC Worksheet in the Reagent Logbook.

C. Interpretation of Results

At minimum, the posterior head with the acrosome present (collectively termed the “head”) is required for positive identification of a sperm cell.

1. Sperm–Anterior Head (Acrosome) = light red → clear
2. Sperm–Posterior Head = dark red
3. Sperm–Mid-piece (mitochondrial sheath) = green
4. Sperm–Tail (flagellum) = green
5. Epithelial cells–Nucleus = light red
6. Epithelial cells–Cytoplasm = light green

D. Slide Disposition

1. Another qualified analyst must confirm all positive identification of sperm cells.
2. All slides prepared by the analyst or provided in the sexual assault kit must contain the laboratory case number, item number, and analyst initials. If the slides do not contain a “frosted” area upon which to write, a diamond-tip applicator may be used to write on the slide itself.
3. When verifying sperm cells, the confirming analyst must ensure the laboratory case number and corresponding item number on each slide matches the laboratory number of the analyst’s notes.
4. Positive slides made from evidence material will be returned with the evidence; however, positive slides may be retained for submission to the DNA section.
5. All negative slides made from evidence will be discarded appropriately.
6. All medical examiner slides are returned after examination.

E. Notes/Documentation

1. If sperm cells are identified, record positive results in the case notes. Another qualified analyst will confirm the positive identification of sperm cells; this confirmation is recorded in the case notes. Describe the stain(s) in the case notes. A thorough description will include the location of the stain or a drawing showing the location of the stain and a measurement of the stain.
 - (a) The analyst may choose to use a scale ranging from “+” to “+++” to indicate the approximate number of cells identified on the slide.
 - (1) +++: Numerous sperm cells are present in every field-of-view of the slide.
 - (2) ++: Several sperm cells are present in every field-of-view of the slide.
 - (3) +: Sperm cells are present, but not in the quantity as described for “++” or “+++.”
 - (b) The analyst may also make additional notes if necessary, i.e. tails present.
2. If no sperm cells are found, record negative results in the case notes.

F. **Assessment of Results**

1. If sperm cells are identified on a sample, no further semen testing is necessary for that sample. The sample is retained using a collection method as outlined in *II. Collection of Stains for Further Testing*.
2. If no sperm cells are found, proceed to p30 testing.

G. **Report Writing Suggestions**

1. **Positive:** A “+ sperm cells” result signifies that sperm cells were identified.
2. **Negative:** DO NOT REPORT- Proceed to p30 testing.

VIII. **Identification of Semen Using the SERATEC® PSA Semiquant**

A. **Scope:** The SERATEC® PSA Semiquant test is designed to detect p30 qualitatively for the forensic identification of semen. p30 is an acceptable marker for detecting semen.

B. **Method**

1. Allow sample (supernatant from *V. Extraction of Suspected Semen Stains for Analysis of Soluble and Particulate Seminal Components*) to warm to room temperature. SERATEC® cards are stored in the refrigerator until day of use; allow SERATEC® cards to warm to room temperature also.
2. Remove SERATEC® card and dropper from sealed pouch.
3. Label SERATEC® cards with the appropriate item number and case number. Only one p30 test is performed per sample.
4. Add approximately 5 drops with the supplied dropper of the supernatant from the extract to the sample well.
5. Read results at 10 minutes.
6. Results past 10 minutes are not valid.

C. **Controls**

1. **Positive Control:** a positive control is performed when new lot numbers are obtained. All results are recorded on the SERATEC® Card Quality Assurance Worksheet in the Reagent Logbook and are indicated in the case notes.
2. **Negative Control:** a negative (reagent) control is performed alongside a positive control when new lot numbers are obtained and is required daily, as necessary. Results of tests performed in conjunction with a positive control are recorded in the Reagent Logbook on SERATEC® Card Quality Assurance Worksheet, and result of the daily negative control is recorded in the case notes. A positive reaction of a negative control renders the test invalid.

D. **Interpretation**

1. **Positive Results:** Three pink lines indicate the test result is positive: one in the test area, one in the control area, and one internal standard line. Note: The test area line must be as dark as or darker than the internal standard line (≥ 4 ng/ml).

2. **Negative Results:** Two pink lines indicate a negative test: one line in the control area and one internal standard line.
A negative result indicates either:
 - (a) No detectable p30 is present.
 - (b) Presence of “High Dose Hook Effect,” which may give false negative results due to the presence of high concentration of p30 in a sample, i.e. undiluted seminal fluid. However, as all samples are diluted using HEPES buffer, the high dose hook effect does not lead to false negative results—seminal fluid tests positive in the dilution range from 1:1 to 1:10 using SERATEC® PSA Semiquant.
3. **Inconclusive Results:** A test that produces a line in the test area that is lighter than the internal standard line (below threshold, < 4 ng/ml).
4. **Invalid:** No pink line visible in the control area or no internal standard line visible renders the test invalid.

E. **Notes/Documentation**

1. If the p30 tests are positive, ≥ 4 ng/ml, record the positive results in the notes. Describe the stain(s) in the case notes. A thorough description will include the location of the stain or a drawing showing the location of the stain and a measurement of the stain.
2. If the p30 test is negative, record the negative result in the notes.
3. If the p30 test is inconclusive, < 4 ng/ml, record the inconclusive results in the notes. Describe the stain(s) in the case notes. A thorough description will include the location of the stain or a drawing showing the location of the stain and a measurement of the stain.
4. The results of the positive and negative controls are recorded in the notes.
5. The SERATEC® cassette test Lot# is recorded in the notes.

F. **Assessment of Results**

1. If the SERATEC® test is positive, then the analyst can report that semen was identified on that item. The sample is then retained using a collection method as outlined in Section II. *Collection of Stains for Further Testing*.
2. If the SERATEC® test is inconclusive, then the analyst can report that tests for semen on that item were inconclusive. The sample may be retained using a collection method outlined in II. *Collection of Stains for Further Testing*.
3. If the SERATEC® test is negative, then the analyst can report that no semen was found on that item.

G. **Report Writing Suggestions**

Use the entire auto text:

A “+ sperm cells” result signifies that sperm cells were identified.

A “+p30” result signifies that no sperm cells were found, but p30 (a component of semen) was identified.

An "INC" result signifies that no sperm cells were found; p30 was indicated, but the quantity was insufficient for conclusive identification.

A "-" result signifies that no semen was chemically identified.

A "no visual/ALS stains" result signifies that no stains characteristic of semen were identified by visual or alternate light source (ALS) examination.

H. *Troubleshooting*

1. **Positive Control** produces a negative result during quality assurance testing. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Obtain a new positive control and retest using a new test cassette.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (b) If testing of new positive control yields negative results then make new HEPES buffer solution.
 - (1) Verify HEPES by retesting old and new positive controls along with a reagent blank and recording in the Reagent Logbook.
 - (2) If testing of positive control yields positive results then discard old HEPES and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
 2. **Negative Control** produces a positive result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Select approximately five new test cassettes from the current lot and test with HEPES buffer only.
 - (1) If testing yields negative results then record findings.
 - (b) If testing yields positive or inconclusive results then make new HEPES buffer.
 - (1) Verify HEPES buffer by selecting two to five cassettes from each remaining box and retesting along with a positive control and recording in the Reagent Logbook.
 - (2) If testing of reagent blanks yield negative results then discard old HEPES buffer and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
 3. **Invalid result:** Internal standard line and or control line are not detectable. Notify the Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Repeat assay with a new test cassette.
 4. A specimen pH-value below 3 or above 12 SU can cause false or invalid results.
 5. A high viscosity of the sample might interfere with the capillary flow.
 6. Do not use test cassettes after the expiration date or if the pouch has been damaged.

IX. Phenolphthalein Test for the Presumptive Screening of Suspected Blood Stains

A. **Scope:** This oxidative test for the presumptive identification of blood is based on catalytic activity of the heme group of hemoglobin. The Phenolphthalein test is also known as the Kastle Meyer test.

B. Method

1. Sample a questioned stain by lightly rubbing with a cotton-tipped applicator moistened with distilled water.
2. Add 1-2 drops of phenolphthalin to the swab and observe for detection of any oxidative contaminants that may be present.
3. Add 1-2 drops 3% hydrogen peroxide and carefully observe to detect any pink color, which usually develops immediately.

C. Controls

1. **Positive Control:** A known blood sample is tested using the method described above. The test is considered positive as indicated in section *D. Interpretation* below.
2. **Negative Control:** A negative control is tested using the method described above. A negative control sample is a sterile, unstained cotton-tipped applicator, which is designated a negative control sample.
3. **Substrate Control:** A moistened swab is applied to an unstained area on the questioned item and is tested using the method described above.

D. Interpretation of Results

1. **Positive Reaction** will show a strong hot pink color within approximately 5 seconds following the addition of the hydrogen peroxide.
2. **Negative Reaction** will not have an **instant** hot pink color.

E. Notes/Documentation

1. The results obtained from testing of questioned stains and substrate controls are recorded in the case notes.
2. The results of the positive and negative controls are recorded in the case notes.

F. Assessment of Results

1. **Positive Result:** Proceed to confirmatory testing procedures for blood.
2. **Negative Result:** No further testing is required.

G. Report Writing Suggestions

Positive: DO NOT REPORT—Proceed to confirmatory testing.

Positive, but not enough sample for confirmatory testing: Presumptive tests for the presence of blood were positive on [Item #]; confirmatory tests were not conducted due to limited sample quantity.

Negative: A “-” result signifies that no blood was chemically identified.

H. Troubleshooting

1. **Positive Control** yields a negative result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Obtain a new positive control and retest.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (b) If testing of new positive control yields negative results then make new phenolphthalin working solution.
 - (1) Verify phenolphthalin working solution by retesting old and new positive controls along with a reagent blank and recording in the Reagent Logbook.
 - (2) If testing of positive control yield positive results, then discard old phenolphthalin working solution and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
2. **Negative Control** yields a positive result. Notify Physical Evidence Section Chief of nonconformity of testing. Document in case notes.
 - (a) Obtain a new reagent blank and retest.
 - (1) If testing of new reagent blank yields negative results, discard previous (old) reagent blank and record findings.
 - (b) If testing of new reagent blank yields positive results, then make new phenolphthalin working solution.
 - (1) Verify phenolphthalin working solution by retesting old and new reagent blanks along with a positive control and recording in the Reagent Logbook.
 - (2) If testing of reagent blanks yield negative results then discard old phenolphthalin working solution and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
3. **Substrate control** produces a positive result.
 - (a) Retest by selecting a different area to use as the substrate control.
 - (1) If negative, record all test results in notes, use the tested area with negative results as the substrate control site, and retain as necessary.
 - (2) If positive, record all test results in notes, select either tested area to use as the substrate control, and retain as necessary.
4. In the absence of blood, the two reagents will begin to react with each other and give a hot pink color with time.
5. The phenolphthalein test is a presumptive test and substances other than blood may yield positive reactions, such as some plant materials (potatoes, horseradish, cabbage, etc.).

X. Takayama Reagent as a Confirmatory Test for Blood

A. **Scope:** Confirmation of the presence of hemoglobin heme in suspected bloodstains is accomplished by preparation of the pyridine hemochromogen derivative as microscopic water-insoluble crystals.

B. *Method*

1. Place a small portion (thread, scraping, cutting, etc.) of the suspected stain on a slide and cover with a fragment of a coverslip.
2. Allow reagent to flow under the coverslip, covering the questioned material. Avoid excess reagent.
3. If needed, place slide on slide warmer or in oven (70 to 80° C for approximately 20–30 seconds). The development of a pink color in and around the sample usually accompanies the reaction.

C. *Controls*

1. **Positive Control:** Reagent reliability is checked daily prior to use in casework by testing a positive control of known blood.
2. **Negative Control:** Reagent reliability is checked daily prior to use in casework by testing a negative control of a sterile swab.

D. *Interpretation of Results*

1. A **positive test** is indicated by the observation of pink feathery crystals of pyridine ferroprotoporphyrin. Use of 100X magnification is usually adequate but higher magnification may be helpful in some cases.
 - (a) Formation of pyridine ferroprotoporphyrin (Takayama crystals) confirms the presence of heme, and hence blood, in the stain.
 - (b) Both high magnification and focusing to view through the depth of the sample are often helpful to locate small crystals or those that may be hidden within the fibers of a fabric sample.
 - (c) Extended periods of time may be required after heating to allow for crystal development. Short time periods (5–10 minutes) of refrigeration at 40° C or freezing at -20° C may also enhance crystal development.
 - (d) Crystal morphology may be altered slightly in decomposing blood; morphology may more resemble plates and/or needles.
2. A **negative test** is indicated by the absence of pink feathery crystals of pyridine ferroprotoporphyrin.

E. *Notes/Documentation*

1. If the Takayama test is positive, record the positive result in the case notes. Describe the stain in the case notes. A thorough description will include the location of the stain or a drawing showing the location of the stain and a measurement of the stain.

2. If the Takayama test does not yield the expected morphology, record the negative result in the case notes.
3. The results of the positive and negative controls are recorded in the case notes along with the lot number of the Takayama reagent.

F. **Assessment of Results**

1. If the Takayama test is positive, then the analyst can report that blood was identified on that item. The sample is then retained using a collection method as outlined in *II. Collection of Stains for Further Testing*.
2. If the Takayama test is negative, then the analyst may report that no blood was found on that item or proceed to HemaTrace® testing of that item.

G. **Report Writing Suggestions**

Positive: A “+” result signifies that blood was identified.

Negative: A “-” result signifies that no blood was chemically identified.

H. **Troubleshooting**

1. **Positive Control** yields a negative result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in case notes.
 - (a) Obtain a new positive control and retest.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (2) If testing of new positive control yields negative results then make new Takayama solution.
 - (1) Verify Takayama working solution by retesting old and new positive controls along with a reagent blank and recording in the Reagent Logbook.
 - (2) If testing of positive control yield positive results then discard old Takayama reagent and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.
2. **Negative Control** yields a positive result. Notify Physical Evidence Section Chief of nonconformity of testing. Document in case notes.
 - (a) Obtain a new reagent blank and retest.
 - (1) If testing of new reagent blank yields negative results, discard previous (old) reagent blank and record findings.
 - (2) If testing of new reagent blank yields positive results then make new Takayama reagent.
 - (1) Verify Takayama reagent by retesting old and new reagent blanks along with a positive control and recording in the Reagent Logbook.
 - (2) If testing of reagent blanks yield negative results, then discard old Takayama reagent and record findings appropriately.
 - (c) Complete Corrective Action Report as necessary.

XI. HemaTrace® as a Confirmatory Test for Blood

- A. **Scope:** The ABACard HemaTrace® test qualitatively detects hemoglobin and is a confirmatory test for forensic identification of blood.
- B. **Method:** HemaTrace® test cards need to be stored in a refrigerator until day of use.
1. A sample (thread, scraping, cutting, or etc.) of the suspected stain is treated in one of the following ways:
 - (a) Place a small portion of the sample in a 1.5ml micro-centrifuge tube and add 8 drops of the supplied buffer to the micro-centrifuge tube, OR
 - (b) Place a small portion of the sample in the entire volume of the buffer in the supplied buffer tube.
 2. Let the sample incubate at room temperature for at least 5 minutes (For samples that are older than 10 years, extend the incubation time to 30 minutes).
 3. Label HemaTrace® test card with the appropriate sample ID and case number.
 4. Briefly mix the sample. Add approximately 4 drops of sample with the supplied dropper to the sample well of the test card.
 5. Read results at 10 minutes (Results are NOT valid past 10 minutes).
- C. **Controls**
1. **Positive Control:** a positive control is run when new lot numbers are obtained. Results are recorded in the Reagent Logbook on HemaTrace® Card Quality Assurance Worksheet and in the case notes.
 - (a) It is recommended that the positive control be prepared from a dilute blood sample so it can be verified that the test is valid at lower levels of hemoglobin.
 - (1) The positive control could be made by adding 50µl whole blood to 1950µl of the supplied buffer.
 - (2) This solution could then be added to filter paper and dried.
 - (3) Small samples, approximately 1mm² in size, could be used as positive controls.
 2. **Negative Control:** a negative (reagent) control is performed alongside a positive control when new lot numbers are obtained and is required daily, as necessary. Results are recorded in the Reagent Logbook on HemaTrace® Card Quality Assurance Worksheet and in the case notes. A positive reaction of a negative control renders the test inconclusive.
- D. **Interpretation**
1. **Positive Results:** Two red lines, one in the test area and one in the control area indicates the test result is positive.
NOTE: Due to the sensitivity of HemaTrace® Test Cards, a POSITIVE Phenolphthalein Presumptive Test is a prerequisite for HemaTrace® testing.
 2. **Negative Results:** Only one red line in the control area indicates the test result is negative. A negative result may indicate

- (a) The test result is negative.
 - (b) Presence of 'High Dose Hook Effect', which may give false negative results due to the presence of high concentration of hemoglobin in a sample. If High Dose Hook Effect is suspected, retest using a 1:10 and 1:100 fold dilutions.
3. **Invalid:** No red line visible in the control area indicates the test is invalid.

E. Notes/Documentation

1. If the HemaTrace® test is positive, record the positive results in the case notes. Describe the stain in the case notes. A thorough description will include the location of the stain or a drawing showing the location of the stain and a measurement of the stain.
2. If the HemaTrace® test is negative, record the negative result in the case notes.
3. The results of the positive and negative controls are recorded in the case notes.
4. The HemaTrace® cassette test Lot# is recorded in the case notes.

F. Assessment of Results

1. If the HemaTrace® test is positive, then the analyst can report that blood was identified on that item. The sample is then retained using a collection method as outlined in *II. Collection of Stains for Further Testing*.
2. If the HemaTrace® test is negative, then the analyst can report that no blood was found on that item.

G. Report Writing Suggestions

Positive: A "+" result signifies that blood was identified.

Negative: A "-" result signifies that no blood was chemically identified.

H. Troubleshooting

1. **Positive Control** produces a negative result during quality assurance testing. Notify Physical Evidence Section Chief of nonconformity in testing. Document in notes.
 - (a) Obtain a new positive control and retest using a new test cassette.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (b) If testing of new positive control yields negative results, open a new box of HemaTrace® cards and test using a new cassette.
 - (1) If testing of new positive control yields positive results, discard previous (old) positive control and record findings.
 - (2) If testing of positive control yields negative results, notify Physical Evidence Section Chief of nonconformity of testing.
 - (c) Complete Corrective Action Report as necessary.
2. **Negative Control** produces a positive result. Notify Physical Evidence Section Chief of nonconformity in testing. Document in notes.

- (a) Select approximately five new test cassettes from the current lot and test with supplied buffer only.
 - (1) If testing yields negative results then record findings.
 - (2) If testing yields positive or inconclusive results, notify Physical Evidence Section Chief of nonconformity in testing.
 - (b) Complete Corrective Action Report as necessary.
3. **Invalid result:** Control line is not detectable. Notify Physical Evidence Section Chief of nonconformity in testing.
Repeat assay with a new test cassette. Document in notes.

SELECTION OF METHODS

The Serology Unit shall use test methods that meet the needs of the customer (refer to Section 4.7 *Service to the Customer*) and are appropriate for the tests undertaken. See *ASCL Quality Manual (ASCL-DOC-01)* for further information regarding Selection of Methods.

CONTROLS AND STANDARDS

COLLECTION OF SUBSTRATE CONTROLS

A substrate control is collected from a non-stained area in close proximity to the stain(s) being retained. This sample is used to ensure that the substrate itself does not interfere with laboratory tests.

A. *Evidence Assessment by Analyst*

1. Substrate controls are collected when tape lifts, cuttings, or swabs are retained from an item.
2. Substrate controls are not necessary under certain circumstances:
 - (a) No swabs, cuttings, or tape lifts are retained from an item.
 - (b) The questioned item is a hard surface.
 - (c) In the case of tape lifts, substrate controls are not necessary for denim, 100% white cotton fabric, light colored fabrics, or smooth fabrics such as nylon windbreakers; however, if a cutting or swab is retained for DNA testing, a substrate control must be collected.

B. *Method*

1. Use clean scissors or a sterile surgical blade.
2. Cut a sample, approximately 1 inch by 1 inch, from an unstained area on the item.
3. If the control cutting will be retained with the DNA cuttings, place the cutting into a clean envelope (coin envelope, #1) and label the exterior front of the envelope with the following information:

ASCL Case Number (YYYY-000000)
Q#-C Description of Control (i.e.
Control cutting of item)

Analyst Initials

- (a) Arkansas State Crime Laboratory Case Number
 - (b) Evidence Number
 - (c) Description of Control
 - (d) Analyst Initials
 - (e) Initial seal on envelope
4. If the control cutting will be retained with the tape lifts, place the cutting onto clear packaging tape and adhere to the acetate sheet containing tape lifts from the item.

C. **Notes/Documentation**

Retained controls shall be documented in analyst's notes.

NEGATIVE CONTROL FOR VERIFICATION OF ACCURACY OF DETECTION TESTS, REAGENTS, AND TECHNIQUES

- A. Sterile swabs will be used as negative controls.
- B. The sample will be subjected to the tests and reagents for which it is used as a negative control in casework and an accurate negative result must be obtained. The date of this verification will be recorded along with the initials of the person performing the verification. This is the only time the negative control needs to be verified; however, when a reagent is used, a sterile swab will be used as a blank. This information will be recorded in the *Reagent Logbook* on form.

The documentation located in the *Reagent Logbook* will be maintained in Room 315, Large Serology Room.

SEMEN STANDARD FOR VERIFICATION OF ACCURACY OF DETECTION TESTS, REAGENTS, AND TECHNIQUES

- A. Dried semen standards used to verify the accuracy of detection tests, reagents, and techniques will be assigned a unique laboratory lot number given as SEM-YY##, whereas SEM indicates a semen standard, YY indicates the year, and ## indicates the number of semen standard prepared in that year. For example, the first semen standard prepared in the year 2012 would be given the unique laboratory lot number of SEM-1201. Document in logbook with the case number of the sample.
- B. There will be one semen standard verified for use per calendar year. This standard will be divided into three portions to supply each laboratory area in the section with adequate sample. When necessary, additional standard(s) may be verified throughout the year if the original standard fails to maintain compliance.
- C. The source of the standard will be documented in the *Reagent Logbook*. However, if the standard is collected from an individual and that person wishes to remain anonymous or is unknown, a general designation of the source may be used instead.

- D. The sample will be subjected to the tests, reagents, and techniques for which it is used as a positive control in casework and an accurate positive result must be obtained. The date of this verification will be recorded along with the initials of the person performing the verification, date sample was collected, and a description of the standard preparation. The expiration date of a semen standard shall be one year, and it may be extended by subjecting the sample to additional verification testing at the end of its expiration date. This information will be recorded in the *Reagent Logbook* on form.
- E. Dried semen standards may be stored in the refrigerator or at room temperature. The documentation located in the *Reagent Logbook* will be maintained in Room 315, Large Serology Room.

BLOOD STANDARD FOR VERIFICATION OF ACCURACY OF DETECTION TESTS, REAGENTS, AND TECHNIQUES

- A. Dried blood standards used to verify the accuracy of detection tests, reagents, and techniques will be assigned a unique laboratory lot number given as BLD-YY##, whereas BLD indicates a blood standard, YY indicates the year, and ## indicates the number of blood standard prepared in that year. For example, the first blood standard prepared in the year 2012 would be given the unique laboratory lot number of BLD-1201.
- B. The donor of the source will be identified, however if an individual donor wishes to remain anonymous or is unknown, a general designation of the source may be used instead.
- C. The sample will be subjected to the tests, reagents, and techniques for which it is used as a positive control in casework and an accurate positive result must be obtained. The date of this verification will be recorded along with the initials of the person performing the verification, date sample was collected, and a description of the standard preparation. The expiration date of a blood standard shall be one year, and it may be extended by subjecting the sample to additional verification testing at the end of its expiration date. This information will be recorded in the *Reagent Logbook* on form.
- D. Dried blood standards may be stored in either the refrigerator or the freezer. The documentation located in the *Reagent Logbook* will be maintained in Room 315, Large Serology Room.

VALIDATION OF METHODS

Information concerning Validation of Methods is located in *ASCL Quality Manual* (ASCL-DOC-01).

SAFE HANDLING

Analysts shall wear proper personal protective equipment, such as that mentioned in the Method Section (5.4), when handling reference samples and controls.

TRANSPORTATION

Reference controls and standards are transported in their given containers, and are to be placed in refrigerated environment (when necessary) upon reaching their destination.

This copy is not controlled.

5.5 Equipment

GENERAL

The Serology Unit has adequate equipment to perform the necessary testing. The equipment is maintained by personnel in the discipline who utilize it.

If the Serology Unit needs to use equipment outside its permanent control, it shall ensure that it meets the requirements of this section.

SEROLOGY EQUIPMENT

1. Water Bath
2. Alternate Light Source
3. Centrifuge
4. Oven
5. View Box
6. Refrigerator
7. Microscope
8. Analytical Balance

PERFORMANCE VERIFICATION

Before equipment is placed into service, performance verification shall be performed to ensure that it meets the specifications required by the appropriate method.

Designated equipment will also be subject to a schedule of performance verifications. All performance verifications shall be properly documented in the Instrument Maintenance and Temperature Log. This log shall be maintained and readily available to each analyst who utilizes it.

WATER BATH PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each water bath in use in the Serology sections. Each water bath is subjected to the temperature performance checks in TABLE 1 on a monthly basis. The results of the checks will be recorded on the appropriate log sheet. Log sheets are filed and archived on a yearly basis.

The analyst will check the temperature of the water bath at each use to verify that the temperature is within the specified temperature range of $37^{\circ}\text{C} \pm 5^{\circ}\text{C}$. This pass/fail verification will be recorded on the examination worksheet.

Should an analyst encounter a problem with the water bath during use, the "Troubleshooting Checks" provided in TABLE 1 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the water bath maintenance requirements.

TABLE 1 Routine Monthly Water Bath Checks and Troubleshooting Guide	
Monthly Checks	Actions
Check water bath temperature	Record temperature
Is the water temperature 37 °C, +/- 5 °C?	If no , adjust temperature setting on water bath, document in maintenance log * If yes , the water bath is ready to use
Troubleshooting Checks	Actions
Is water level sufficient for testing?	Add water as necessary (It is not necessary to document when water is added to the water bath)

* If the water bath temperature remains outside acceptable temperature range after adjustment, the water bath must be removed from service for repair/replacement. After water bath is repaired/replaced, water bath temperature must be checked prior to return to service. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

ALTERNATE LIGHT SOURCE PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each alternate light source in use in the Serology sections. The alternate light source does not require regular performance verification. Log sheets are filed and archived on a yearly basis.

Should an analyst encounter a problem with the alternate light source during use, the “Troubleshooting Checks” provided in TABLE 2 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the alternate light source maintenance requirements.

TABLE 2 ALTERNATE LIGHT SOURCE Troubleshooting Guide	
Troubleshooting Checks	Actions
Is light bulb damaged?	If damaged, replace bulb, document in maintenance log
Is the wavelength set to 450nm?	Adjust as necessary
Are the correct lenses being used?	Yellow lenses are recommended at 450nm

If any of the above actions fail to correct the problem then the alternate light source must be removed from service for repair/replacement. After the alternate light source is repaired/replaced, the alternate light source should be checked to ensure proper functionality and wavelength. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

CENTRIFUGE PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each centrifuge in use in the Serology sections. The centrifuge does not require regular performance verification. Log sheets are filed and archived on a yearly basis.

Should an analyst encounter a problem with the centrifuge during use, the “Troubleshooting Checks” provided in TABLE 3 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the centrifuge maintenance requirements.

TABLE 3 CENTRIFUGE Troubleshooting Guide	
Troubleshooting Checks	Actions
Is the centrifuge on a level surface?	If no , place on a level surface
Does the centrifuge shake during use?	If yes , balance tubes
Does a pellet form after use?	If no , check speed and time settings

If any of the above actions fail to correct the problem then the centrifuge must be removed from service for repair/replacement. After the centrifuge is repaired/replaced, the centrifuge should be checked to ensure proper functionality. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

OVEN PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each oven in use in the Serology sections. The oven does not require regular performance verification. Log sheets are filed and archived on a yearly basis.

Should an analyst encounter a problem with the oven during use, the “Troubleshooting Checks” provided in TABLE 4 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the oven maintenance requirements.

TABLE 4 OVEN Troubleshooting Guide	
Troubleshooting Checks	Actions
Is it warm?	If no , adjust temperature If yes , oven is fit for use

If any of the above actions fail to correct the problem then the oven must be removed from service for repair/replacement. After the oven is repaired/replaced, the oven should be checked to ensure proper functionality. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

VIEW BOX PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each view box in use in the Serology sections. The oven does not require regular performance verification. Log sheets are filed and archived on a yearly basis.

Should an analyst encounter a problem with the view box during use, the “Troubleshooting Checks” provided in TABLE 5 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the view box maintenance requirements.

TABLE 5 VIEW BOX Troubleshooting Guide	
Troubleshooting Checks	Actions
Is it warm?	If no , adjust temperature If yes , view box is fit for use

If any of the above actions fail to correct the problem then the view box must be removed from service for repair/replacement. After the view box is repaired/replaced, the view box should be checked to ensure proper functionality. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

REFRIGERATOR PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each refrigerator in use in the Serology sections. Each refrigerator is subjected to the performance checks in TABLE 6 on a monthly basis. The results of the checks will be recorded on the appropriate log sheet. Log sheets are filed and archived on a yearly basis.

See TABLE 8 for the refrigerator maintenance requirements.

TABLE 6 Routine Monthly Refrigerator Checks	
Monthly Checks	Actions
Check refrigerator temperature	Record temperature
Is the refrigerator temperature between 0 and 10 °C?	If no , adjust temperature setting on refrigerator, document in maintenance log * If yes , the refrigerator is fit for use
Check freezer temperature (if applicable)	Record temperature
Is the freezer temperature between -14 and -26 °C (if applicable)?	If no , adjust temperature setting on freezer, document in maintenance log * If yes , the freezer is fit for use

* If the refrigerator or freezer temperature remains outside acceptable temperature range after adjustment, the unit must be removed from service for repair/replacement. After refrigerator is repaired/replaced, refrigerator and freezer (if applicable) temperature must be checked prior to return to service. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

MICROSCOPE PERFORMANCE VERIFICATION & MAINTENANCE (PREVENTATIVE)

An *Instrument Maintenance and Temperature Log Sheet* is provided for each microscope in use in the Serology sections. The microscopes do not require regular performance verification. Log sheets are filed and archived on a yearly basis.

Should an analyst encounter a problem with the microscope during use, the “Troubleshooting Checks” provided in TABLE 7 will assist the analyst in determining the problem so it may be corrected. Any maintenance resulting from a Troubleshooting Check will be recorded on the appropriate log sheet.

See TABLE 8 for the microscope maintenance requirements.

Troubleshooting Checks	Actions
Is the light bulb damaged?	If damaged, replace bulb, document in maintenance log
Are the settings appropriate for analyst use?	Adjust as necessary

If any of the above actions fail to correct the problem then the microscope must be removed from service for repair/replacement. After the microscope is repaired/replaced, the microscope should be checked to ensure proper functionality. All repairs and maintenance must be documented on the *Instrument Maintenance and Temperature Log Sheet*.

ANALYTICAL BALANCE PERFORMANCE VERIFICATION & MAINTENANCE

The DNA section maintains the calibration of the analytical balance and performs any necessary maintenance. The analyst will check the balance log prior to using the balance to ensure the proper performance verification and maintenance has been completed.

EQUIPMENT TRAINING

Only individuals who have been trained in the proper use of the equipment are authorized in its use.

EQUIPMENT IDENTIFICATION

Each piece of equipment is labeled with a unique identifier; those unique identifiers are recorded in the *Instrument Maintenance and Temperature Log Sheet* kept in Room 315 (Large Serology Room).

The *Instrument Maintenance and Temperature Log Sheet* is readily available for analysts using equipment that has a significant effect on the quality of test results. The records include the following information:

1. Identity of the equipment
2. Manufacturer name, model number, serial number, and asset number, if applicable
3. Location of the equipment (room #)
4. Manufacturer’s instructions, if available, or reference to their location

5. Maintenance log, including any damage, malfunction, modification, or repair to the equipment
6. Date permanently removed from service, if applicable

When equipment is retired, the records shall be maintained and available for at least one full ASCL/LAB International accreditation cycle (5 years).

HANDLING AND MAINTENANCE OF EQUIPMENT

See ASCL *Quality Manual* (ASCL-DOC-01) for general information regarding Handling and Maintenance of Equipment.

Maintenance of equipment having a significant impact on the quality of results is a planned activity. See TABLE 8.

Equipment	Maintenance Required	Frequency of Maintenance
Water Bath	Clean interior of water bath (drain water bath, clean interior, refill with water to appropriate level, allow water to warm, check temperature)	Annually Document in maintenance log
Alternate Light Source	Clean alternate light source (clean exterior surfaces)	Annually Document in maintenance log
Centrifuge	Clean centrifuge (remove the spinning bowl and clean the interior of centrifuge, clean the spinning bowl, replace the spinning bowl, clean exterior surfaces)	Annually Document in maintenance log
Oven	Clean oven (clean interior and exterior surfaces)	Annually Document in maintenance log
View Box	Clean view box (clean exterior surfaces)	Annually Document in maintenance log
Refrigerator	Clean refrigerator (clean interior and exterior surfaces)	Annually Document in maintenance log
Microscope	Clean microscope (clean exterior surfaces)	Annually Document in maintenance log

All equipment shall be checked for cleanliness annually.

5.6 Measurement Traceability

CALIBRATION REQUIREMENTS

Analytical Balance

The DNA section maintains the calibration of the analytical balance and performs any necessary maintenance. The analyst will check the balance log prior to using the balance to ensure the proper performance verification and maintenance has been completed.

Reference Materials

The Serology Unit has a procedure for the verification of its reference materials.
See Section 5.4 Controls and Standards.

This copy is not controlled.

5.7 Sampling

The Serology Unit performs specific sample selection rather than sampling as defined by ASCLD/LAB.

Sample selection is a practice of selecting items to test, or portions of items to test, based on training, experience, and competence. Sample selection answers questions only about the portion tested. There is no assumption of homogeneity of the whole.

Example: Pair of pants with four stains—one stain is chosen to be tested based on the analyst's experience.

DEVIATIONS

Deviations as requested by the customer or as deemed appropriate by the analyst shall be approved by the Physical Evidence Section Chief and maintained in the case record.

RECORDS

The sample selection process used in routine casework, as documented in the Serology Quality Manual, is not required to be recorded in the case notes. The examination record will contain any observations, drawings, diagrams, or images that the serologists have made and that may be appropriate to support the selection of test items.

This copy is not controlled.

5.8 Handling of Test Items

The Serology Unit complies with *ASCL Quality Manual* (ASCL-DOC-01) Section 5.8, Handling of Test Items. See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Handling of Test Items.

EVIDENCE RETENTION

Samples (e.g. cuttings, swabs, and tape lifts) retained for analysis by the DNA Section will be placed in the locked cabinet labeled “FD Secure Storage” in Room 313.

Samples (e.g. hairs and tape lifts) retained for analysis by the TRACE Unit or the DNA Section will be placed in the locked cabinet labeled “PE Secure Storage” in Room 315.

Samples retained for potential future analysis will be placed in the locked cabinet labeled “Long Term Storage.”

Storage locations for all retained evidence will be recorded in JusticeTrax.

CHAIN OF CUSTODY

Evidence tracking within the laboratory is done using the LIMS and is described in the *Evidence Receiving Quality Manual* (ER-DOC-01).

EVIDENCE SEALING

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Evidence Sealing.

TEST ITEM IDENTIFICATION

A unique case number is assigned to every case when evidence is initially received by ASCL. Each exterior container must have its unique barcode label affixed to it.

Serology section employs the use of Q and K numbers in identification of test items and known samples, respectively. Questioned items, those items examined for the presence of body fluids, are labeled with Q numbers, i.e. Q1, Q2, etc. Known samples, e.g. known blood samples or known oral swabs or known hair samples, are labeled with K numbers, i.e. K1, K2, etc.

Samples retained from questioned items are further labeled with sub-item identifiers that designate the type of sample retained, e.g. Q#-1S, Q#-1B, Q#-1T, Q#-C where “S” indicates a stain initially identified for semen testing, “B” indicates a stain initially identified for blood testing, “T” indicates an area initially identified as possible transfer, and “C” indicates a control sample. However, a sample identified as Q#-1S may also be tested for blood and conversely, a sample identified as Q#-1B may be tested for semen.

SUITABILITY OF TEST ITEMS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Suitability of Test Items.

SAFEGUARDING THE INTEGRITY OF EVIDENCE

See ASCL *Quality Manual* (ASCL-DOC-01) for further information regarding Safeguarding the Integrity of Evidence.

SECURING EVIDENCE

All evidence not in the process of examination/analysis shall be maintained in a secure, limited-access storage area under proper seal.

Each Serologist work area is equipped with lockable cabinets where evidence can be stored. Items too large for the work area cabinets may be placed in a scrape-down room or other locked room for overnight or other long-term storage.

UNATTENDED EVIDENCE

Evidence in the process of examination may be left unattended for a reasonable period of time in a secure limited-access area. The analyst shall take reasonable precautions to protect the evidence from loss, cross-transfer, contamination, and deleterious change.

EVIDENCE IN THE PROCESS OF EXAMINATION

Items with an expectation of frequent analysis may be considered “evidence in the process of examination/analysis” and may be stored unsealed in a limited-access area as long as the evidence is protected from loss, cross-transfer, contamination, and deleterious change.

EVIDENCE MARKING

All evidence will be marked or identified with the laboratory case number (e.g. YYYY-000000), if practical. Otherwise, the proximal container must be marked or identified with the laboratory case number.

This copy is not controlled.

5.9 Assuring the Quality of Test Results

GENERAL

The Serology Unit of the Physical Evidence Section maintains a quality manual, which contains quality control procedures and continually monitors and ensures the validity of test results.

CONTROLS AND STANDARDS

Documentation of controls and standards employed by the Serology Unit are described in the Method Section (5.4).

QUALITY CONTROL DATA

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Quality Control Data.

Methods concerning nonconformity of testing in control/standard data are described in the Method Section (5.4).

PROFICIENCY TESTING

Each Serologist will take one Body Fluid Identification proficiency test per year, at minimum.

External proficiency tests will be obtained from an ASCLD/LAB approved provider unless special circumstances arise and an internal test is needed or warranted.

Internal proficiency tests may include previous external proficiency samples, samples retained from casework, re-examination techniques, or blind techniques.

PROFICIENCY TESTING—DISCIPLINE REQUIREMENTS

The Serology Unit will successfully complete at least one external proficiency test annually.

PROFICIENCY TESTING-DOCUMENTATION REQUIREMENTS

The Physical Evidence Section Chief or designee shall maintain a log of proficiency testing in the individual's Employee History Binder.

The Physical Evidence Section Chief is responsible for comparing the analytical results to the expected results, determining if the analytical results are acceptable, and for reviewing these results with the analyst.

If there is a discrepancy between the expected results and the experimental results, the Physical Evidence Section Chief must notify the Quality Assurance Manager. If the results are deemed unsatisfactory, the Physical Evidence Section Chief must initiate a Corrective Action Request in Qualtrax.

PROFICIENCY RECORD RETENTION

Proficiency testing records will be retained for at least 15 years.

CASE REVIEW

All cases must be **TECHNICALLY** and **ADMINISTRATIVELY** reviewed. After a report has been written, the header of the review form (SER-FORM-07) will be completed by the analyst. This form will be placed in the folders marked for **TECHNICAL** review. Upon completion of this review, the form will be placed in the folder marked for **ADMINISTRATIVE** review. Once the administrative review is complete, the review form will be scanned into Case Images in JusticeTrax.

If a reviewer discovers an error in the case record, the reviewer must document the error on the review form and inform the analyst. If the analyst and reviewer cannot reach a consensus, then both the analyst and review must meet with the Section Chief (or designee) for resolution. If the error is typographical or otherwise minor in nature, a verbal conversation between the analyst and the reviewer is appropriate.

If any corrective actions were made on the review sheet, the **ADMINISTRATIVE** reviewer will return the sheet to the Section Chief upon completion of the administrative review.

TECHNICAL REVIEW REQUIREMENTS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Technical Review Requirements.

TECHNICAL REVIEWERS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Technical Reviewers.

ADMINISTRATIVE REVIEW

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Administrative Review.

ADMINISTRATIVE REVIEW REQUIREMENTS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Administrative Review Requirements.

TESTIMONY REVIEW

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Testimony Review.

TESTIMONY RECORD RETENTION

Records of testimony monitoring will be retained for at least 15 years.

5.10 Reporting the Results

SEROLOGY REPORT WRITING SUGGESTIONS (USE THE CURRENT AUTO TEXT)

SEMEN RESULTS:

A "+ sperm cells" result signifies that sperm cells were identified.

A "+p30" result signifies that no sperm cells were found, but p30 (a component of semen) was identified.

An "INC" result signifies that no sperm cells were found; p30 was indicated, but the quantity was insufficient for conclusive identification.

A "-" result signifies that no semen was chemically identified.

A "no visual/ALS stains" result signifies that no stains characteristic of semen were identified by visual or alternate light source (ALS) examination.

BLOOD RESULTS:

A "+" result signifies that blood was identified.

A "-" result signifies that no blood was chemically identified.

A "no visual stains" result signifies that no stains characteristic of blood were identified by visual examination.

PUBIC HAIR COMBINGS:

No hairs were recovered from

SAMPLES:

Item(s)

Cutting(s) from

Tape lift(s) from

Swab(s) from

Hair(s) from

KNOWN SAMPLE REQUESTS:

In order to complete additional testing, known oral swabs are needed from

LABORATORY REPORT EXCEPTIONS

See *ASCL Quality Manual (ASCL-DOC-01)* for further information regarding Laboratory Report Exceptions.

REPORTS

See *ASCL Quality Manual (ASCL-DOC-01)* for further information regarding Reports.

ADDITIONAL STATEMENTS

The following statement shall be included on reports issued under a Serology Request, "Only those items expressly detailed in the results below were analyzed for this report."

STATEMENTS ON SAMPLING

The Serology Unit performs specific sample selection. Certain information is to be included in the examination notes regarding samples collected and retained:

- a) Unambiguous identification of the item sampled/retained
- b) When applicable, the location of sampling, which may include a written description of the location, diagrams, sketches, or photographs.
- c) Description of size of stains that are being retained. Approximate measurements may be used, i.e. ~ ½ inch diameter, ~ 1" x 1"; descriptive measurements may also be used, i.e. stain covers entire crotch, ~80% of garment was covered.

Any samples retained from an item of evidence will be indicated on the report. See *Serology Report Writing Guidelines* above.

RELEASING REPORT INFORMATION

Please refer to ASCL-DOC-01 Section 4.13.1.3 *Confidentiality of Records* details procedures for the release of report information.

REPORT/TESTIMONY ON WORK OF OTHER ANALYSTS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Report/Testimony on Work of Other Analysts.

OPINIONS AND INTERPRETATIONS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Opinions and Interpretations.

ELECTRONIC TRANSMISSION OF RESULTS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Electronic Transmission of Results.

REPORT FORMAT

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Report Format.

SUPPLEMENTAL AND AMENDED REPORTS

See *ASCL Quality Manual* (ASCL-DOC-01) for further information regarding Supplemental and Amended Reports.