The NIST/NIJ Technical Working Group on Biological Evidence Preservation: Best Practice Handbook in Progress

Margaret Kline
National Institute of Standards and Technology Gaithersburg, MD
Member of NIST/NIJ Technical Working Group on Biological Evidence Preservation

Technical Working Group on Biological Evidence Preservation

A partnership between the **National Institute of Standards and Technology**, Law Enforcement Standards Office and the **National Institute of Justice**, Office of Investigative and Forensic Sciences

Inaugural meeting took place in August 2010

Broad goal to “establish proper collection, storage, and preservation techniques throughout the forensic science disciplines”

We just had our 8\(^{th}\) meeting (June 13, 14 in Baltimore MD)
The NIST/NIJ Technical Working Group on Biological Evidence Preservation (TWGBEP) is charged with:
creating best practices and guidance to ensure the integrity, prevent the loss, and reduce the premature destruction of biological evidence after collection through post-conviction proceedings.
21 TWGBEP Members
Initial Observations

Evidence can be found in a variety of places e.g.:

- Law Enforcement Property/Evidence Rooms
- Laboratory Property/Evidence Rooms
- Court Property/Evidence Rooms
- Prosecutor’s Offices, Detective’s Desk drawer,…
- Hospitals

Finding:
- Better methods need to be established to be able to track evidence across the different agencies.
Handbook on Biological Evidence Preservation

Audience

– All handlers of biological evidence (emphasizing property and evidence custodians)

– Challenge to encompass small to large agencies
5 Major Sections of the Handbook

I. Retaining Biological Evidence
II. Biological Evidence Safety & Handling
III. Packaging and Storing Biological Evidence
IV. Tracking Biological Evidence Chain of Custody
V. Biological Evidence Disposition
Additional Areas of the Handbook

Additional Resources: Web page references for:

- Packaging and Collection Guidance
- Property and Evidence Associations
- Biohazard Disposal Guidelines

Appendix A:
- Evidence Tracking and Management Systems

Appendix B:
- List of Evidence Retention Laws

Appendix C:
- Notification of Destruction Mechanisms

Glossary

Bibliography
Retaining Biological Evidence

The purpose of this section is to provide guidance to prevent the premature destruction of biological evidence. To achieve that, this section includes:

• Guidance regarding biological evidence identification
• Recommendations on the retention of biological evidence for certain crime categories
• Recommendations on the retention of biological evidence for different case statuses
Biological Evidence Safety & Handling

The purpose of this section is to provide guidance on biological evidence safety and handling concerns and includes:

- Discussion of universal Precautions
- Guidance regarding the use of personal protective equipment (PPE)
- Guidance regarding exposure control plans
- Guidance on the disposal of regulated waste
Handbook on Biological Evidence Preservation

Packaging and Storing Biological Evidence

The purpose of this section is to provide guidance on the proper packaging and storage of evidence containing biological material. To achieve that, this section includes:

- Guidance on packaging different types of biological evidence
- High and low tech methods to dry wet evidence
- Best practices regarding the use of containers and individual item packaging
- Guidance on the appropriate conditions for biological evidence storage
- A discussion on storage location considerations
- A list of references for further guidance and training
Tracking and Chain of Custody Section

The purpose of this section is to provide guidance to improve both the chain-of-custody process and the tracking of evidence to enhance the integrity of the criminal justice system. To achieve that, this section includes

- Guidance on the importance of chain of custody
- Best practices on managing and tracking evidence
- A discussion comparing tracking systems and minimum requirements
- Best practices and sample procedures on securing biological evidence
- Best practices for evidence management in locations such as the courthouse or hospital
- Recommendations on communications and oversight
Biological Evidence Disposition

The purpose of this section is to provide guidance to improve the administrative efficiency of the disposition of biological evidence. To achieve that, this section includes:

• Best practices for the process of evidence disposition
• Key elements to include in departmental manuals or polices regarding biological evidence disposition

Disposition is the ongoing process of determining what to do with evidence in a case. The process includes retention and disposal, destruction, auction, diversion to governmental agency use or returning to owner.
Packaging and Storing Biological Evidence

Drying Wet evidence

Metal lockers  Fiberglass Shower stall  Tiled room  Commercial Drying Cabinet

All enclosures must be decontaminated between uses
Packaging and Storing Biological Evidence

**Frozen**: Laboratory freezer storage temperatures at or below –10°C (14°F)

**Refrigerated**: Stored between 2°C (35°F) and 8°C (46°F) with less than 25% humidity

**Temperature Controlled**: Stored between 15.5°C (60°F) and 24°C (75°F) with less than 60% humidity

**Room Temperature**: No temperature or humidity control guidelines
## Temporary Storage

<table>
<thead>
<tr>
<th>Type of Evidence</th>
<th>Frozen</th>
<th>Refrigerated</th>
<th>Temperature Controlled</th>
<th>Room Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Blood</td>
<td>Never</td>
<td>Best</td>
<td>≤24 hours</td>
<td></td>
</tr>
<tr>
<td>Urine</td>
<td>Best</td>
<td>≤24 hours</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Biological Stained Items</td>
<td></td>
<td>Best</td>
<td></td>
<td>Acceptable</td>
</tr>
<tr>
<td>Wet Bloody Items (dry ASAP)</td>
<td>Best</td>
<td>Acceptable</td>
<td>≤24 hours</td>
<td></td>
</tr>
<tr>
<td>Bones</td>
<td></td>
<td>Best</td>
<td></td>
<td>Acceptable</td>
</tr>
<tr>
<td>Hair</td>
<td></td>
<td>Best</td>
<td></td>
<td>Acceptable</td>
</tr>
<tr>
<td>Swabs with Biological Material</td>
<td>Best (wet)</td>
<td>Best (dry)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal Smears</td>
<td></td>
<td>Best</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feces</td>
<td></td>
<td>Best</td>
<td></td>
<td>≤24 hours</td>
</tr>
<tr>
<td>Buccal Swabs</td>
<td></td>
<td>Best</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DEFINITIONS:**

Temporary Storage: refers to the period between the time when an officer submits an item with evidentiary value into a locker or other facility, and the time that it is removed and documented as received into the property room by property room personnel.

Frozen: Stored by freezing at a constant temperature at or below –10°C (14°F)

Refrigerated: Stored between 2°C (35°F) and 8°C (46°F) with less than 25% humidity

Temperature Controlled: Stored between 15.5°C (60°F) and 24°C (75°F) with less than 60% humidity

Room Temperature: No humidity control

Dry: Evidence that has been fully dried so that no liquid (blood, semen, etc,) can drip from the object that it exists upon.
**Long Term Storage**

<table>
<thead>
<tr>
<th>Type of Evidence</th>
<th>Frozen</th>
<th>Refrigerated</th>
<th>Temperature Controlled</th>
<th>Room Temp</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liquid Blood</td>
<td>Never</td>
<td>Best</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine</td>
<td>Best</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dry Biological Stained Items</td>
<td>Best</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bones</td>
<td>Best</td>
<td></td>
<td>Acceptable</td>
<td></td>
</tr>
<tr>
<td>Hair</td>
<td>Best</td>
<td></td>
<td>Acceptable</td>
<td></td>
</tr>
<tr>
<td>Swabs with Biological Material</td>
<td>Best (dry)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vaginal Smears</td>
<td>Best</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feces</td>
<td>Best</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Buccal Swabs</td>
<td>Best</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DNA Extracts</td>
<td>Best(liq) → Acceptable(liq)</td>
<td>Acceptable (dry)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**DEFINITIONS**

**Long-Term Storage of Biological Evidence:** A long-term storage location must be designated to secure all biological evidence or property items in the custody of the agency for the duration of the time it is held in the property room, until the items are diverted, sold, released, or destroyed.

**Frozen:** Stored by freezing at a constant temperature at or below −10°C (14°F)

**Refrigerated:** Stored between 2°C (35°F) and 8°C (46°F) with less than 25% humidity

**Temperature Controlled:** Stored between 15.5°C (60°F) and 24°C (75°F) with less than 60% humidity

**Room Temperature:** No humidity control
Evidence for the Storage conditions

- Extensive literature search
- Review of the “newer” preservation materials, advances in technology
- Room temperature stability studies maturing
- On going experiments by the NIST Human Identity Project Team members
Partial Reference list


This category includes blood, semen, saliva, and vaginal swabs that are dry.


Liquid:

DNA recovered from 10 year old bloodstains

Three different extraction methods used duplicated samples. Stains on 903 paper

<table>
<thead>
<tr>
<th>Sample Storage</th>
<th>Extraction Method A</th>
<th>Extraction Method B</th>
<th>Extraction Method C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lab Ambient</td>
<td>52 ng</td>
<td>75 ng</td>
<td>11 ng</td>
</tr>
<tr>
<td>-20 °C</td>
<td>49 ng</td>
<td>43 ng</td>
<td>13 ng</td>
</tr>
<tr>
<td>-80 °C</td>
<td>42 ng</td>
<td>45 ng</td>
<td>9 ng</td>
</tr>
<tr>
<td>Liq N₂</td>
<td>43 ng</td>
<td>37 ng</td>
<td>11 ng</td>
</tr>
</tbody>
</table>
Quality of the Extracted DNA

<table>
<thead>
<tr>
<th>L</th>
<th>+37 C</th>
<th>RT</th>
<th>-20 C</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>FTA 1</td>
<td>FTA 5</td>
<td>FTA 9</td>
</tr>
<tr>
<td>2</td>
<td>903 2</td>
<td>903 6</td>
<td>903 10</td>
</tr>
<tr>
<td>3</td>
<td>903 3</td>
<td>903 7</td>
<td>903 11</td>
</tr>
<tr>
<td>4</td>
<td>903 4</td>
<td>903 8</td>
<td>903 12</td>
</tr>
</tbody>
</table>

L ladder with 250 bp, 400 bp, 800 bp and 1500 bp bands visible
Lanes 1, 2: +37 °C FTA; Lanes 3, 4: +37 °C 903;
Lanes 5, 6: RT FTA; Lanes 7, 8: RT 903;
Lanes 9, 10: -20 °C FTA; Lanes 11, 12: -20 °C 903;

Most STR typing kits have products that are less than 450 bp.

After 11 years of storage at 37 °C both FTA and 903 show signs of degradation, the FTA samples exhibit DNA with slightly higher molecular weight than the 903 samples.
FTA – 903 +37  C Storage Idfiler
Alleles dropping out with Idfiler amplification are recovered with Minifiler
25 year old Bloodstain (1986)  
PowerPlex 18D (903 paper)

Single 1.2 mm punch stored at room temperature  
No Extraction  
Data from Pete Vallone and Erica Butts NIST Human Identity Project Team members
Data from DNA extracts stored in PFA tubes at -80 °C, 4 °C, and Lab ambient temperature for 6 years. Each storage temperature had three DNA concentrations: neat, 1→5 dilution, and 1→10 dilution. qPCR results of triplicate aliquots are displayed with error bars representing 2 sd. There is no difference as a result of temperature storage after 6 years.
Chain-of-custody documentation should include the following:

- Description of the evidence
- Unique case identifier (e.g., case number)
- Where the evidence was collected
- Where the evidence was stored
- Who was in possession of the evidence and for what purpose.
- What was done to the evidence (e.g., analysis)
- Date and time information
Tracking Biological Evidence
Electronic Evidence Management

- Reporting capabilities (including statistics)
- Tracking capabilities
- Alert Mechanisms (“Tickler File”)
- Integration with existing systems
- Security
- Inventory Management
- Communication (enhancing data sharing with other CJ agencies)
- Accessibility - web-based hosted solution vs server based
- Usability (ease of use)
- Customization (creating a system to meet your needs)
- Data Conversion
- IT and Hardware Support
- Training
- Appropriate Capabilities for the size of agency
- Electronic Signature Capabilities
- Cost benefit analysis for individual features considered (understand value added for each)
Property Custodian Checklist for the Final Disposition of Biological Evidence:

- Review cases on a regular basis using a “tickler” system or evidence case tracking system. Also, any of the notification/authorization mechanisms discussed previously may initiate the disposition process.
- Notify the investigator or court to determine case status.
- Get final sign off from the designated authority to disposition evidence.
- Ensure compliance with any statutes, policies, and procedures that may require court orders or notifications before disposal.
- Actual disposition should be done in compliance with state and federal health and safety laws using certified biological disposal vendors.
Thank you for your Attention!!

Email: Margaret.Kline@nist.gov

Acknowledgments

NIST Law Enforcement Standards Office
NIJ Office of Investigative & Forensic Sciences
TWGBEP members

Forensics@NIST 2012

Three day symposium on cutting edge forensic science research at NIST

SAVE THE DATES

Date: November 28-30th, 2012
Time: 9:00 am to 5:00 pm
Location: NIST (Gaithersburg, Maryland)

For more information:
www.nist.gov/oles/forensics-2012.cfm
Note: registration is required