Findings of the Technical Working Group on Biological Evidence Preservation

National Commission on Forensic Science
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"In order for qualified forensic science experts to testify competently about forensic evidence, they must first **find the evidence in a usable state and properly preserve it**."

- *NAS Report*

What does your evidence room look like?

“Bad” Evidence Rooms

“Bad” Evidence Rooms

“Good” Evidence Rooms

“Good” Evidence Rooms

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NIST/NIJ Technical Working Group on Biological Evidence Preservation

Group Charge:

To create 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.

TWG Membership

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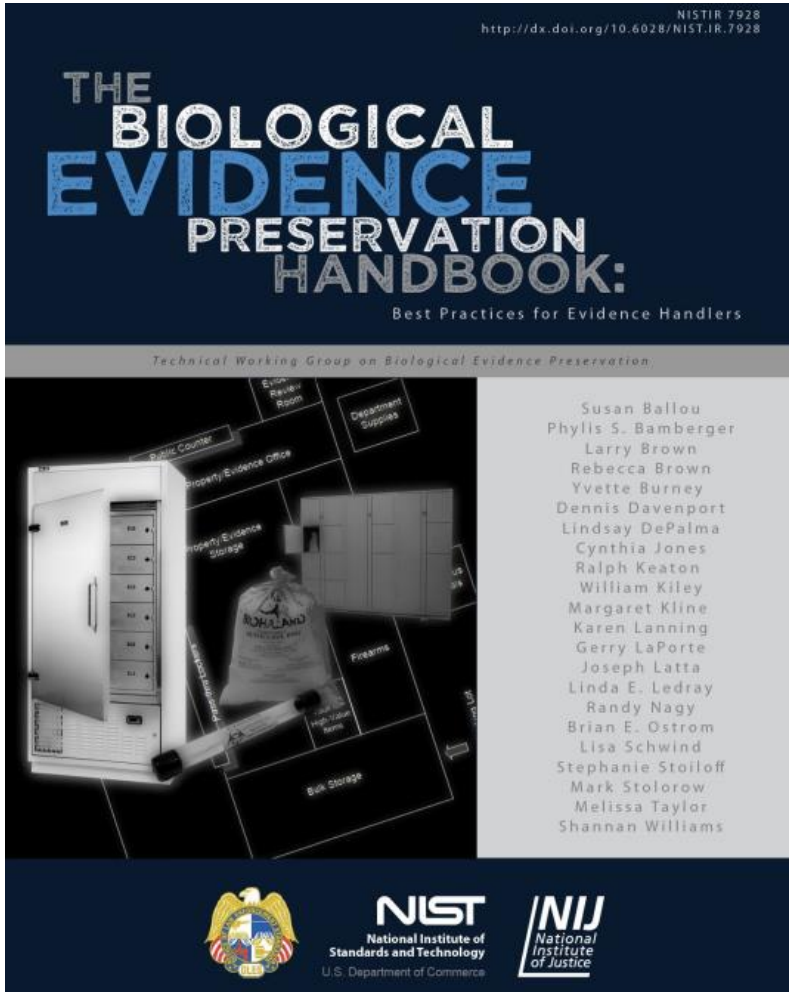
TWG Outputs Overview

- Three reports published since 2012
- Reports sought to:
  - Understand practical challenges and provide specific best practices
  - Promote advanced technologies to improve tracking and storage of evidence
  - Facilitate implementation by considering applicable rules, law, and policy

TWG Outputs

1. ***The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers*** *(published in April 2013)*

http://www.nist.gov/forensics/evidence-management.cfm



Key Recommendations

- In the *Handbook*, the TWG recommends:
  - Specific **environmental storage guidelines** for long and short term storage of biological evidence types based on scientific literature review
  - Standardization of **packaging, labeling, and shelving** for improved retrieval
  - Practices to improve **safety** in handling biological materials which can be hazardous
  - Protocols for the **disposition** of biological evidence

Short and Long Term Storage Matrices

Table III-1: Short-Term Storage Conditions Matrix[1]

Type of Evidence[2]	Frozen	Refrigerated	Temperature	Room
Liquid Blood[3]				
Urine				
Dry Biological Stained Item[4]				
Wet Bloody Items (if cannot be dried)				
Bones				
Hair				
Swabs with Biological Material				
Vaginal Smears				
Feces				
Buccal Swabs				

Table III-2: Long-Term Storage Conditions Matrix[1]

Type of Evidence[2]	Frozen	Refrigerated	Temperature Controlled	Room Temperature
Liquid Blood	Never	Best		
Urine	Best			
Dry Biological Stained Items			Best	
Bones			Best	
Hair			Best	Acceptable
Swabs with Biological Material			Best (dried)	
Vaginal Smears			Best	
Feces	Best			
Buccal Swabs			Best	
DNA Extracts	Best (liquid)	Acceptable (liquid)	Acceptable (dried)	

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Short and Long Term Storage Matrices

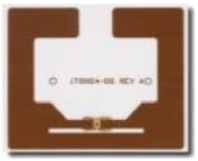
Biological evidence should be stored in one of the following conditions, depending on the type of evidence, and if known, the type of analysis that will be conducted:

- **frozen**: temperature is maintained thermostatically at or below –10 °C (14 °F)
- **refrigerated**: temperature is maintained thermostatically between 2 °C and 8 °C (36 °F and 46 °F) with less than 25 % humidity
- **temperature controlled:** temperature is maintained thermostatically between 15.5 °C and 24 °C (60 °F to 75 °F) with less than 60 % humidity
- **room temperature:** temperature is equal to the ambient temperature of its surroundings; storage area may lack temperature and humidity control methods

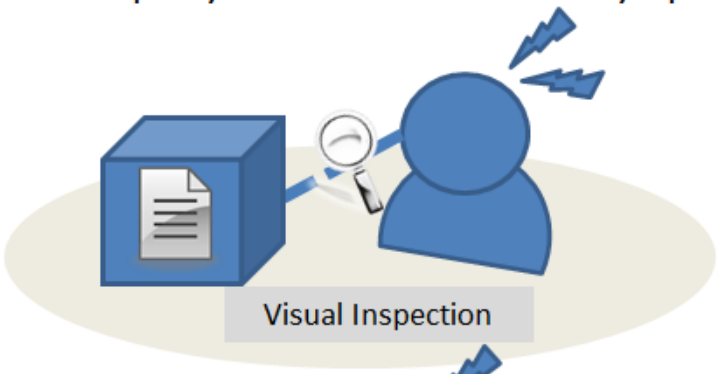
TWG Outputs

2. ***RFID Technology in Forensic Evidence Management: An Assessment of Barriers, Benefits, and Costs*** *(published in November 2014)*

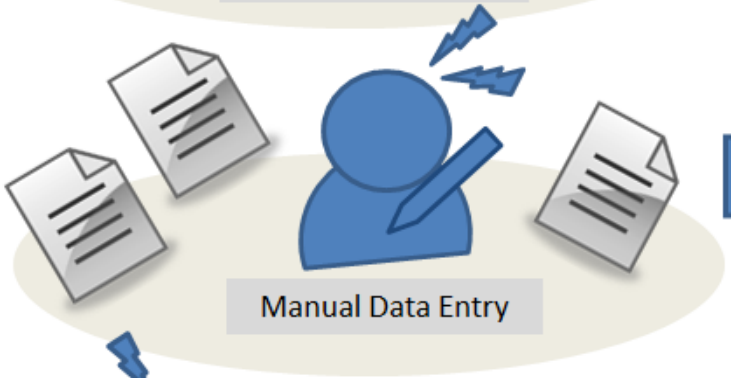
http://www.nist.gov/forensics/evidence-management.cfm



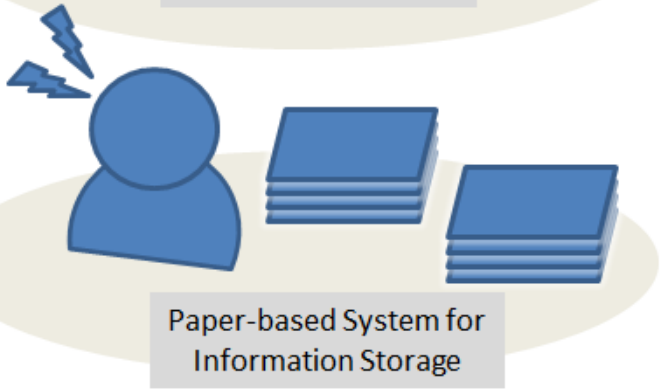
Current Property and Evidence Inventory Operations



Visual Inspection



Manual Data Entry

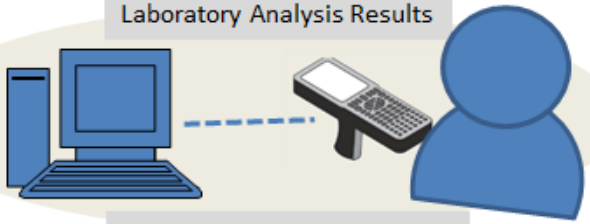


Paper-based System for Information Storage

Operations with RFID Solution

Tag Affixed to Evidence Item and read by a manual or fixed reader

Tag contains data on:
Evidence Item Identifier
Chain of Custody
Case Information
Environmental Conditions
Laboratory Analysis Results



Information on reader is stored on computer system

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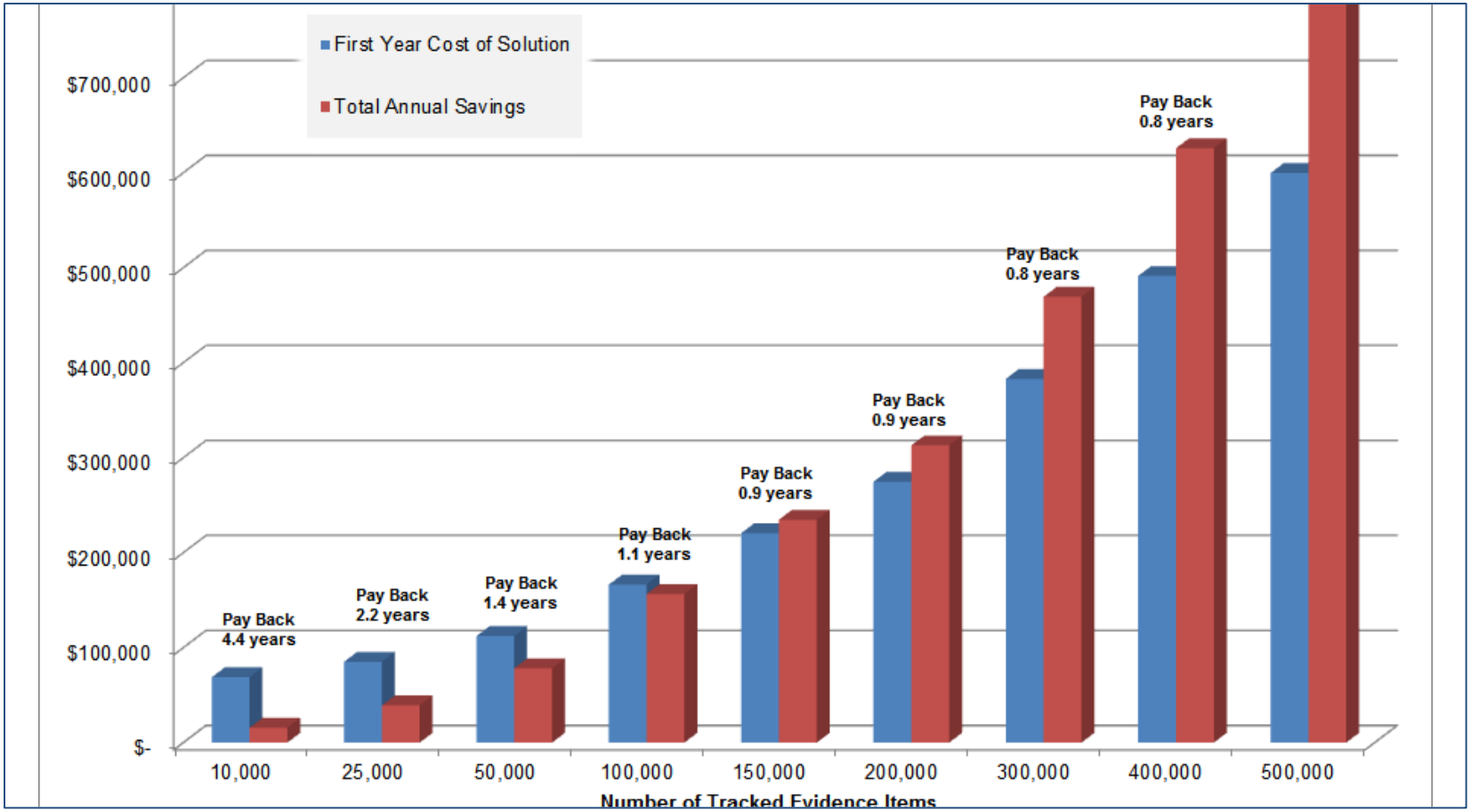
Key Recommendations

- In *RFID in Forensic Evidence Management*, the authors discuss:
  - Automated identification technologies such as **RFID and barcoding and capabilities** applicable to law enforcement
  - **Barriers** to implementation
  - **Return on Investment** of implementing RFID in property and evidence room
  - **A way forward** for law enforcement agencies implementing AIT

RFID Return on Investment



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The Need for Standards

- Evidence Labeling

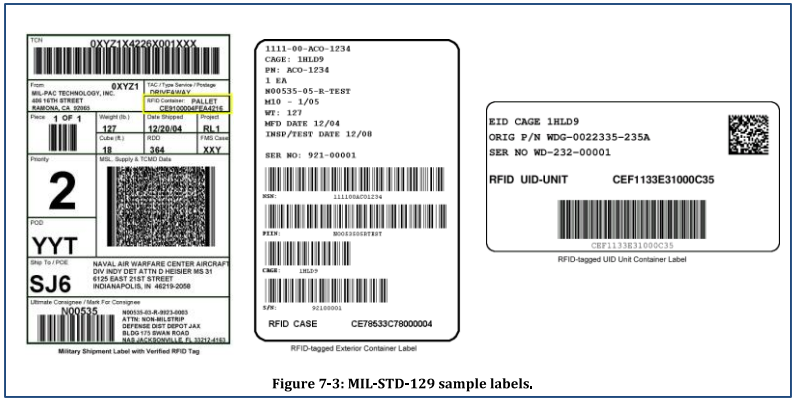
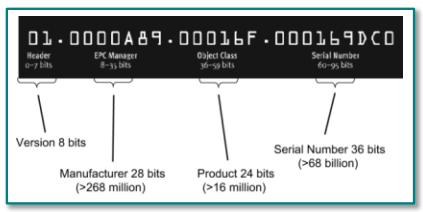


Figure 7-3: MIL-STD-129 sample labels.

- Evidence Numbering



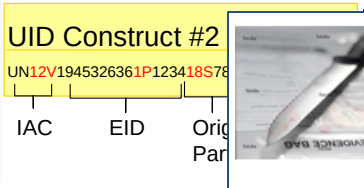


Figure 7-1: EPC encoding standard versus IUID data standar

Figure 7-2: Forensic Evidence Identification.

- Data Exchange

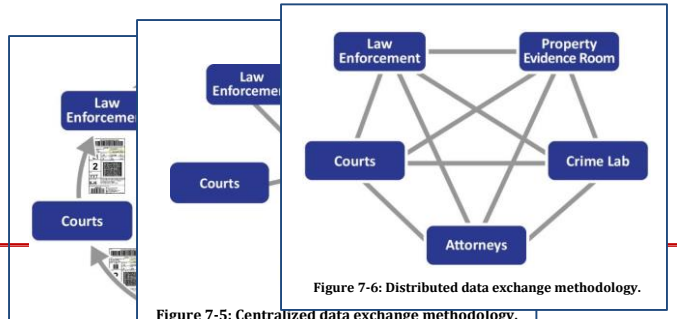


Figure 7-4: Label-based data exchange methodology.
Figure 7-5: Centralized data exchange methodology.
Figure 7-6: Distributed data exchange methodology.

http://nvlpubs.nist.gov/nistpubs/ir/2014/NIST.IR.8030.pdf
Pg. 28-33

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Property and Evidence Management Capability Maturity Model

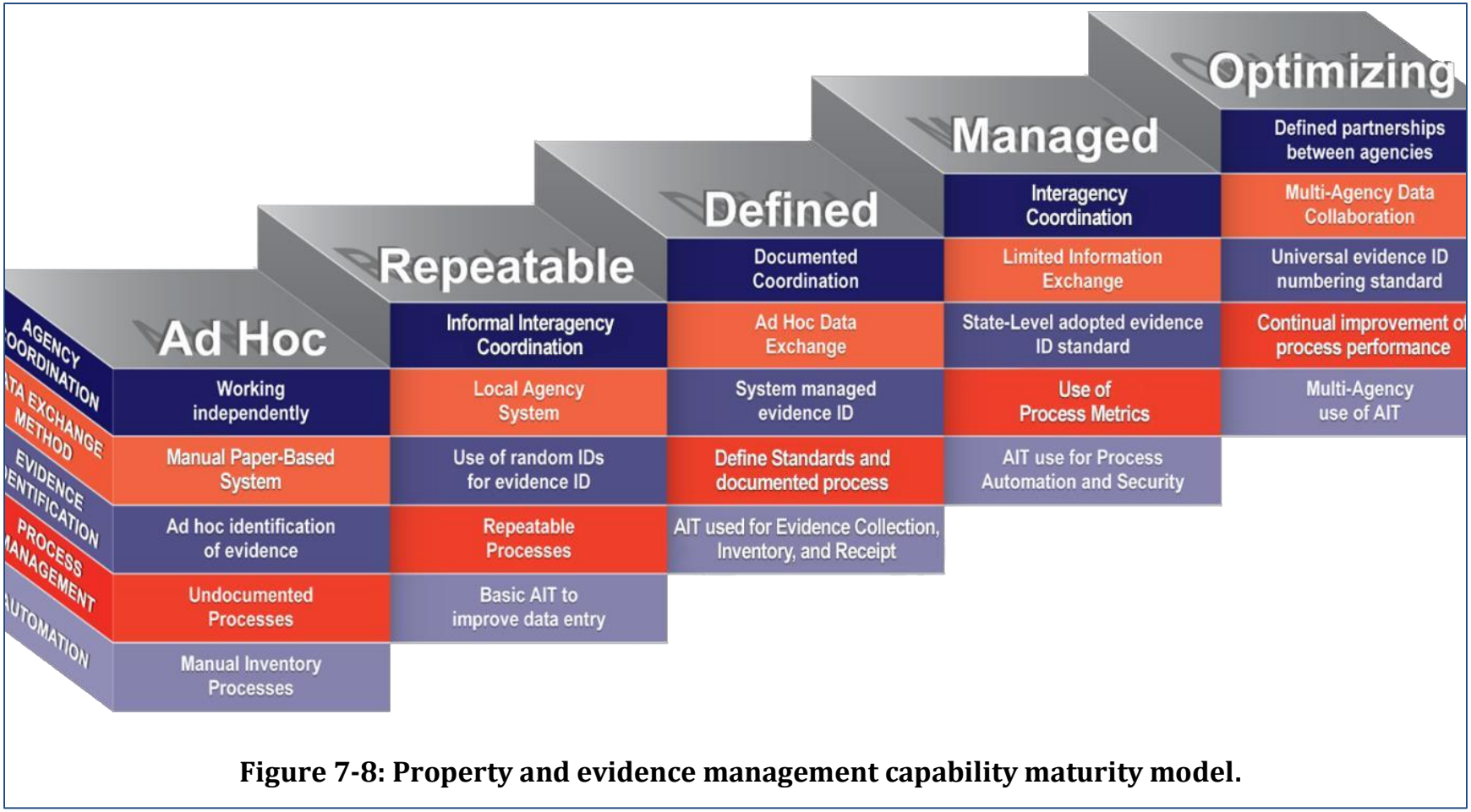

Figure 7-8: Property and evidence management capability maturity model.

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TWG Outputs

NEW

3. ***Biological Evidence Preservation: Considerations for Policy Makers***

(Published April 2015)

http://www.nist.gov/forensics/evidence-management.cfm

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Overview

- While **43 states and the District of Columbia** have enacted statutes related to the preservation of biological evidence, policies and procedures can be enacted in states that currently have no laws and for those States looking to make improvements.
- Policy brief intended to provide guidance to legislators, advocates, and managers within criminal justice agencies that influence policy.
- Uses examples from existing State statutes, and a thorough examination of current trends, law, scientific literature and the expertise of the membership.
- Does not endorse any particular state statute.

Biological Evidence Definition

- To ensure that evidence is properly preserved, all potential handlers must have a clear understanding of what constitutes biological evidence.
- Defining biological evidence in a statute can prevent ambiguity within jurisdictions and among the various agencies that may potentially handle biological evidence.

Biological Evidence Definition

- **Recommendation 1:**

Policy makers should define biological evidence as follows: “Evidence commonly recovered during a criminal investigation in the form of skin, hair, tissue, bones, teeth, blood, semen, or other bodily fluids, which may include samples of biological materials, or evidence items containing biological material.” ‡

‡Technical Working Group on Biological Evidence Preservation. 2013. *The Biological Evidence Handbook: Best Practices for Evidence Handlers.* NIST IR 7928. Gaithersburg, MD.: National Institute of Standards and Technology. http://www.nist.gov/manuscript-publication-search.cfm?pub_id=913699; DNA Initiative. 2012. “Glossary.” Accessed July 5. http://www.dna.gov/glossary.

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Automatic Evidence Retention

- The majority of statutes (31 out of 43) contain provisions that require states to automatically preserve biological evidence.
- However, a few other state statutes require that biological evidence be retained with the qualification that some form of petition or court order is made.
- In the absence of an automatic retention policy, however, there is a period of time in which the evidence can be legally destroyed before a petition for testing is filed. This time may last for years and can result in the unwarranted destruction of evidence that could be tested and found to be exculpatory.

Automatic Evidence Retention

- **Recommendation 2:**

Policy makers in each state should establish statutes, rules, or policies that require the automatic retention of biological evidence by government entities from the time of collection through the recommended timeframes set forth in Table 3-1.

Retention Timetables

<table>
<tr><th></th><th colspan="4">CASE STATUS</th></tr>
<tr><th>Crime Categories (NIBRS)[1]</th><th>Open[2]</th><th>Charges Filed</th><th>Adjudicated</th><th>Unfounded/ Refused/Denied/ No Further Investigation</th></tr>
<tr><td>Homicide Offenses</td><td>Retain indefinitely</td><td>Retain indefinitely</td><td>At a minimum, retain for the length of incarceration</td><td>Dispose of upon receipt of authorization[3]</td></tr>
<tr><td>Sexual Offenses</td><td rowspan="3">At a minimum, retain for the length of the statute of limitations</td><td rowspan="3">Retain pending adjudication</td><td>At minimum, retain for the length of incarceration</td><td rowspan="3">Dispose of upon receipt of authorization</td></tr>
<tr><td>Assault Offenses, Kidnapping/ Abduction, Robbery</td><td></td></tr>
<tr><td>All Other Group A & B Offenses</td><td>Dispose of upon receipt of authorization</td></tr>
</table>

Environmental Conditions

- Among the states with biological evidence preservation laws, only **15** include a requirement that biological evidence be properly stored.

> "Evidence shall be preserved in a manner reasonably calculated to prevent contamination or degradation of any biological evidence that might be present, subject to a continuous chain of custody, and securely retained with sufficient official documentation to locate the evidence.."
>
> (North Carolina) N.C. Gen. Stat. Ann. § 15A-268(a1) (West 2009).

Environmental Conditions

- **Recommendation 4:**

Policy makers in each state should establish statutes, rules, or policies that require biological evidence be stored in appropriate environmental conditions, based on known scientific practices, in order to prevent its loss, degradation, or contamination.

A Mechanism for Accountability/Enforcement

- Of the 43 biological evidence preservation statutes examined, only **six states address the issue of evidence management** in their statutes with mandates and/or directions relating to the promulgation of regulations and/or standards regarding preservation.

A Mechanism for Accountability/Enforcement

"(b)The **director of the crime laboratory within the department of state police, in consultation with the forensic sciences advisory board** established by section 184A of chapter 6, shall promulgate regulations governing the retention and preservation of evidence or biological material by any governmental entity. The regulations shall include standards for maintaining the integrity of the materials over time, the designation of officials at each governmental entity with custodial responsibility and requirements for contemporaneously recorded documentation of individuals having and obtaining custody of any evidence or biological material.

(Massachusetts) Mass. Gen. Laws. Ch. 278A § 16(b) (2011)

A Mechanism for Accountability/Enforcement

Recommendation 5:

- Policy makers in each state should designate an authority with a statutory bound responsibility, such as a statewide commission(s) or working group(s), to establish and enforce standards consistent with best forensic scientific practices for the proper retention, preservation, cataloging, and retrieval of biological evidence applicable to criminal investigations, criminal prosecutions, and post-conviction proceedings.

Other Topics Covered

- Bulk Evidence
- Early Disposition
- Remedies for Denial of Access

All of the documents discussed are available at:

http://www.nist.gov/forensics/evidence-management.cfm

THANK YOU!

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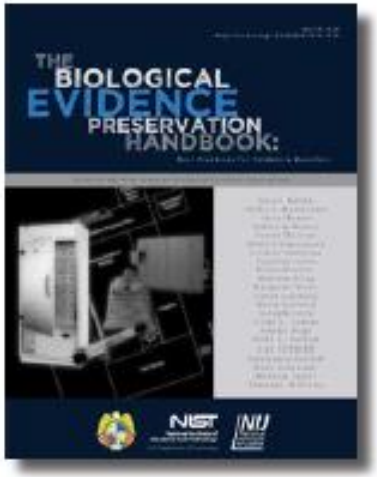
BACK-UP



Given the power of DNA evidence, it is hard to believe that it is not in the best interest of the criminal justice system to do all it can to preserve this evidence using the best method available.

Strengthening Forensic Science?

The National Institute of Standards and Technology (NIST) and the National Institute of Justice (NIJ) have recently released "The Biological Evidence Preservation Handbook: Best Practices for Evidence Handlers" [Handbook] to provide guidance on the handling and preservation of biological evidence. Due to the wide variety of this form of evidence, it is difficult to provide "one size fits all" guidance for the handling, packaging and storage of biological evidence and the Handbook does a reasonable job in most of these areas. However, one of the key recommendations made in this publication is that biological evidence stains should be stored long term under "temperature controlled conditions" [see Table III-2, page 19 of the Handbook, reproduced below]. In the Handbook, "temperature controlled conditions" have been defined to mean biological evidence should be stored between 60-75 degrees F and below 60% humidity. Since short term storage conditions are defined to mean storage for less than 72 hours, the recommendation for long term "temperature controlled conditions" will be the prevailing recommendation. It is my concern that these storage conditions are not adequate to preserve the more marginal categories of dried biological evidence which includes trace or degraded biological samples.

This recommendation was discussed on the forens-DNA list and I responded to the inquiry because I had performed a study of the impact of time and storage conditions on old biological samples [I posted a summary of this study on forens-DNA]. Two of the conclusions I reached as a result of this study were: (1) "**... frozen storage preserved biological samples better than a combination of storage conditions** (frozen, refrigeration & room temperature) **or holding a dry biological sample at room temperature**" and (2) "The majority of the stains in this study yielded very informative DNA typing profiles when amplified by the Profiler Plus reagent kit. Most of the samples analyzed in this study had been stored for at least some time period in the freezer. It was clear that samples did not have to be stored frozen in order to obtain a DNA result. [Given, that a full profile was obtained on a bloodstain held at room temperature for more than 25 years.] **However, there was also some information to indicate that samples benefited from frozen storage since the only samples that did not display a decrease in the DNA at the larger loci were the samples that had been held frozen.**"

I was able to obtain the scientific papers referenced in the Handbook to support the "controlled temperature" recommendation for long term storage and found that these articles are: (1) typically relying on relatively large biological samples [e.g. 50ul of blood], (2) that placed on clean substrates and (3) stored for a comparatively short time frames [usually less than 2 years]. Considering the time frame of some high profile "cold cases" in California, a 2 year period does not appear to be what could be considered a worst case scenario for evidence storage. In short, the samples and conditions described in the references supporting the Handbook's recommendation do not come close to reflecting the reality of most evidence samples encountered as biological evidence in "cold cases." Thus, although these recommendations might be appropriate for relatively large, uncontaminated blood, semen or saliva stains, they are likely not appropriate for the type of biological evidence that is frequently encountered in criminal cases. Ironically, several of the articles cited in the Handbook to support the recommendation for long term storage conditions for stains also **make it clear that DNA does degrade over time and that biological samples benefited from being stored at cold temperatures** [e.g. Aggarwal et al. 1992; Koblinsky, 1992; Sjoholm et al. 2007; and McCabe et al. 1987]. Further, these studies often only focused on ability to obtain a DNA profile in samples that contain a relatively large amount of DNA and ignored: (1) how degraded the DNA might be after storage, (2)how MUCH DNA was preserved, and (3) the possible need to preserve other markers in these stains [e.g. proteins or RNA]. While protein or RNA markers may not be frequently pivotal in a case, evolving technology could make them significant and it is likely that these markers would also survive better in a frozen state than at "controlled temperature" conditions.

"Given the power of DNA evidence, it is hard to believe that it is not in the best interest of the criminal justice system to do all it can to preserve this evidence using the best method available."

-Theresa Spear
CAC News, 1st QTR 2014

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To Freeze or Not to Freeze Biological Evidence

TWG did not to recommend that all biological evidence be frozen for the following reasons:

1.Scientific research and current trends in DNA analysis.

2.Evidence is often held in multiple locations throughout it's lifecycle.

***3. Lengthy retention times required by legislation make freezing all biological evidence types extremely costly*.**