

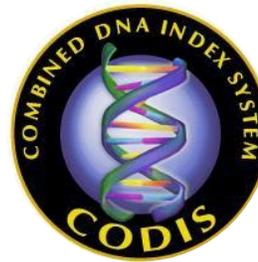
U. S. Department of Justice
Federal Bureau of Investigation
Science and Technology Branch



Guide to All Things Rapid DNA

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Laboratory Division
Biometrics Analysis Section
2501 Investigation Parkway
Quantico, VA 22135

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1. Overview of Rapid DNA

This document explores multiple aspects of Rapid DNA, discusses how the FBI is moving forward with the implementation of Rapid DNA for CODIS, and provides resources for agencies with Rapid DNA implementation questions.

Rapid DNA, or Rapid DNA analysis, is a term used to describe the fully automated process of developing a DNA profile from a reference sample mouth swab in 1-2 hours without the need for a DNA laboratory and without any human interpretation. The overall goal of the Rapid DNA initiative is to immediately enroll qualifying arrestees in CODIS so that every arrestee is searched against all unsolved crimes in CODIS within 24 hours. The FBI also has established the DNA Index of Special Concern (DISC) containing complete crime scene profiles from unsolved homicide, sexual assault, kidnapping and terrorism cases. Using Rapid DNA, DISC profiles can be searched in near real time during the booking process. A match to a DISC profile will result in an immediate notification to the booking agency, arresting agency and investigating agency via the Wants and Warrants network, NLETS. This technology has the potential to dramatically impact law enforcement’s ability to generate investigative leads while an arrestee is still in custody, possibly preventing additional crimes and making communities safer.

Rapid DNA is **not** currently approved for use on crime scene samples for enrollment and/or search in CODIS. There are many challenges that must be overcome before Rapid DNA devices can be reliably used for crime scene sample analysis for CODIS entry and search. The FBI continues to assess how these challenges can be addressed to include monitoring enhancements to Rapid DNA technology; working with other Federal, State and Local law enforcement partners; and interfacing with the Rapid DNA industry to help advance this technology. It is important to note Rapid DNA requires more sample than conventional laboratory processing.

Rapid DNA at a Glance

	Booking Station	Accredited Laboratory	Law Enforcement Agency
Approved Rapid DNA devices for casework reference sample mouth swabs	NO	YES	NO
Approved for qualifying arrestee mouth swabs for CODIS	YES	YES	NO
National Standards and Procedures for processing qualifying reference sample mouth swabs for CODIS	YES	YES	NO
Best practice guidance for non-CODIS use of Rapid DNA	NO	YES	YES
Approved to process crime scene samples for CODIS	NO	NO	NO

2. Booking Station Rapid DNA

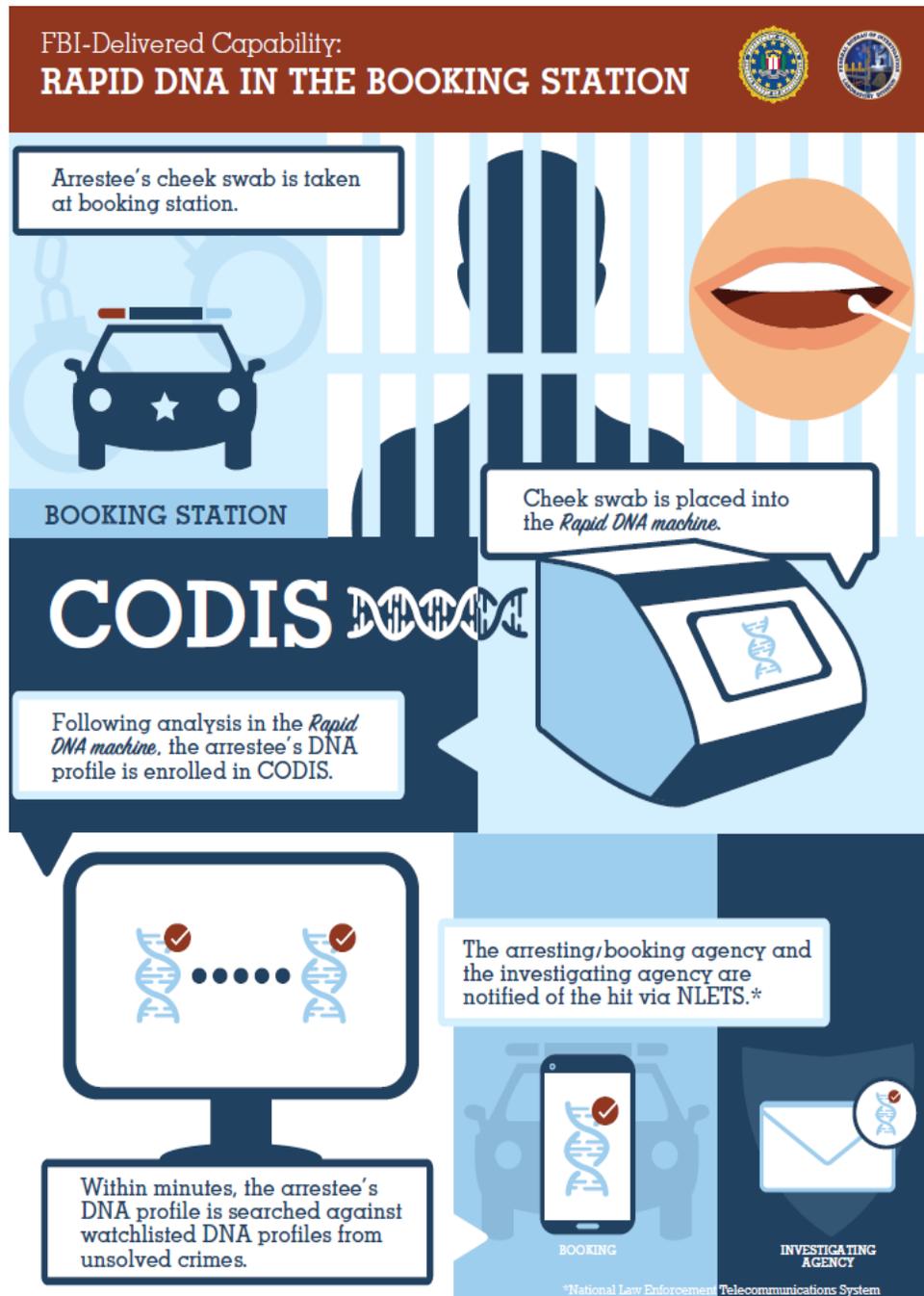


Figure 1: This graphic represents the high-level concept of operation for Rapid DNA in the Booking Station. A qualifying arrestee's mouth swab is taken at arrest and placed into a Rapid DNA device. Following analysis, the arrestee's DNA profile is immediately enrolled into CODIS and searched against a special watchlisted set of DNA profiles from high interest unsolved crimes. A match will result in an immediate notification to the booking agency, arresting agency and investigating agency via the Wants and Warrants network, NLETS.

The Rapid DNA Act of 2017 ([Public Law 115-50](#)) became Federal law on August 18, 2017. The Act authorizes the FBI Director to “issue standards and procedures for the use of Rapid DNA instruments and resulting DNA analyses.” The FBI Laboratory Division worked with the FBI Criminal Justice Information Services (CJIS) Division and the CJIS Advisory Policy Board (CJIS APB) Rapid DNA Task Force to plan for the effective integration of Rapid DNA into the booking station process. The FBI also worked with their DNA advisory body, the Scientific Working Group for DNA Analysis Methods (SWGDM) and other stakeholders to develop *Standards for the Operation of Rapid DNA Booking Systems by Law Enforcement Booking Agencies*, the corresponding *Audit Document* for these standards, and the *National Rapid DNA Booking Operational Procedures Manual* for the FBI approval and operation of the Rapid DNA devices in booking agencies for immediate CODIS enrollment.

The FBI recognizes that National DNA Index System (NDIS) approval of Rapid DNA Booking Devices and the training of law enforcement personnel in use of the approved devices are integral to ensuring that Rapid DNA is used in a manner that maintains the quality, integrity and public trust of our National DNA Database to combat crime.

2.1. Booking Station Integration Planning

The State CODIS Agency is the primary agency for the implementation of Rapid DNA in the booking environment for a state. It is critical for booking agencies to work with their State CODIS Agency to ensure all requirements are met when implementing Rapid DNA in the booking environment. A great initial resource for states considering the implementation of Rapid DNA in the booking station can be found [here](#). Information Technology (IT) enhancements, including automated fingerprint capture (Live Scan) and criminal history information integration, are required for booking station submission of arrestee DNA profiles to CODIS.

Below is an abbreviated list of requirements for federal, state, and local booking agencies to utilize Rapid DNA (for a complete list see [National Rapid DNA Booking Operational Procedures Manual](#)):

- The state must have implemented an arrestee DNA sample collection law that authorizes DNA sample collection at the time of arrest where there are no additional requirements (i.e., determination of probable cause) for the analysis of the arrestee DNA sample. Federal booking agencies already meet this prerequisite.
- The state/booking agency must integrate Electronic Fingerprint (Live Scan) capture during the booking process for obtaining State Identification Numbers (SID) (UCN for federal booking agencies) from the State Identification Bureau (FBI for federal) in near real time.
- The booking agency must have network connectivity with the State Identification Bureau (SIB)/CJIS Systems Agency (CSA).
- The booking agency and/or state must integrate Rapid DNA within their automated fingerprint process in a way that ensures only qualifying arrestees are processed.

Links to important documents for the implementation of Rapid DNA at the booking station:

- [Considerations for States Implementing Booking Station Rapid DNA](#)
- [National Rapid DNA Booking Operational Procedures Manual](#)

- [Standards for the Operation of Rapid DNA Booking Systems by Law Enforcement Booking Agencies](#)
- [CODIS Arrestee Enrollment Format](#)
- [CODIS Rapid Import Format](#)
- [Original Rapid DNA Booking Station Requirements](#)

2.2. Approved Booking Station Devices

Rapid DNA Booking Device(s) approved for use at NDIS by a law enforcement booking station:

- **ANDE 6C Series G** (effective February 1, 2021)
- **RapidHIT™ ID DNA Booking System v1.0** (effective July 1, 2021)

For the most up-to-date list of approved devices, please see the FBI's main Rapid DNA website [here](#).

*It is important to note that NDIS approval of a Rapid DNA Booking Device **does not include approvals demonstrating compliance with the CJIS Security Policy required by state and local IT networks.** Such approvals shall be obtained before implementation of an NDIS approved Rapid DNA Booking Device in a law enforcement booking agency.*

2.3. Benefits of Booking Station Rapid DNA

Integration of Rapid DNA at the booking station for qualifying arrestees has many benefits. These benefits include, but are not limited to:

- Improved sample collection compliance of qualifying arrestees
 - Prevents missed collections
 - Prevents duplicate collections of samples already in CODIS
 - Prevents collection of non-qualifying arrestees
- DNA results are loaded into CODIS while the arrestee is in custody
 - Immediate searching of the arrestee against high-interest unsolved crimes (DISC)
 - Searching of all crimes in CODIS within 24 hours
 - Generates immediate investigative leads
 - Eliminates arrestee confirmation process since identity is confirmed prior to enrollment in CODIS

3. Crime Scene Samples and Rapid DNA

Since the enactment of the Rapid DNA Act of 2017, there has been significant interest by law enforcement to use Rapid DNA on crime scene samples. Uploading to and/or searching CODIS and NDIS is **not** currently authorized for crime scene samples processed by Rapid DNA. [Enhancements](#) to the Rapid DNA technology are needed to bring the technology into compliance with the [FBI Quality Assurance Standards \(QAS\) for Forensic DNA Testing](#).

Mouth swabs are ideal for Rapid DNA devices, as they contain large amounts of fresh DNA from one individual. However, crime scene samples can vary widely due to factors such as age, exposure to the elements, or characteristics related to the amount and quality of DNA. Of critical concern, crime scene samples often contain mixtures of DNA from more than one individual which require interpretation by a trained scientist. For these reasons, all crime scene samples must be processed by an accredited forensic DNA Laboratory that follows the FBI Quality Assurance Standards for Forensic DNA Testing Laboratories to be eligible for the CODIS system.

3.1. Addressing Challenges with Crime Scene Samples and Rapid DNA

The FBI is committed to addressing the challenges with crime scene samples to ensure reliable use of Rapid DNA for crime scene CODIS entry and searching in the future. The FBI continues to address these challenges by monitoring the enhancements to Rapid DNA and interfacing with the Rapid DNA industry. Among the major challenges are the development of expert systems for automated interpretation of single source crime scene samples, the ability to interpret mixtures of DNA from more than one individual, and the requirement to determine the amount of DNA present in a sample (necessary to maximize the resulting quality of the DNA profile, assess for contamination, etc.). Major milestones to date for addressing these challenges are listed below.

- **March 2018:** In coordination with the National Institute of Justice (NIJ), the FBI invited all major law enforcement organizations to a meeting in Washington, DC to discuss Rapid DNA. The meeting led to the formation of the FBI's Rapid DNA Crime Scene Task Force to investigate the potential use of Rapid DNA for the analysis of crime scene evidence. The Task Force is composed of two Task Groups: The Non-CODIS Rapid DNA Best Practices/Outreach and Courtroom Considerations Task Group (**non-CODIS Best Practices Task Group**) and The Rapid DNA Crime Scene Technology Advancement Task Group (**Advancement Task Group**).
- **July 2018:** The Scientific Working Group on DNA Analysis Methods (SWGDM) formed the Forensic DNA Casework Expert Systems Working Group to explore the potential use of expert systems for the automated interpretation of single source crime scene samples in an accredited DNA laboratory. Lessons learned from successful implementation in the laboratory setting can be applied to single source crime scene Rapid DNA samples in the future.
- **September 2019:** The non-CODIS Best Practices Task Group published "[Non-CODIS Rapid DNA Considerations and Best Practices for Law Enforcement Use](#)" on FBI.gov. This product of the non-CODIS Best Practices Task Group provides valuable guidance for the use of Rapid DNA for non-CODIS purposes. It is important to note that there seems to be a potential triage role for Rapid DNA. Using a Rapid DNA device to triage crime scene samples would require the collection of duplicate samples (A-Swab / B-Swab) using the bouquet method described in the [Non-CODIS Rapid DNA Considerations and Best Practices for Law Enforcement Use](#) document.

One sample (A-Swab) would be collected for submission to the forensic laboratory for analysis using current DNA technology. A second sample (B-Swab) would be collected and could be analyzed immediately using the Rapid DNA device in the field for investigative or triage purposes. Only the results from the accredited forensic laboratory analysis would be used for upload and/or search in CODIS and for court testimony purposes.

- July 2020:** The Advancement Task Group published a joint position statement with the Scientific Working Group on DNA Analysis Methods (SWGDM) and the European Network of Forensic Science Institutes (ENFSI) titled “Rapid DNA for crime scene use: Enhancements and data needed to consider use on forensic evidence for State and National DNA Databasing – An agreed position by ENFSI, SWGDAM, and the Rapid DNA Crime Scene Technology Advancement Task Group” ([Forensic Science International: Genetics 48 \(2020\) 102349](#)). The Advancement Task Group is diligently working with the Rapid DNA industry regarding these required enhancements as well as developing a multi-laboratory testing plan to evaluate the enhancements once they are available. Data and recommendations from the multi-laboratory study will be presented to SWGDAM for consideration.
- August 2020:** The non-CODIS Best Practices Task Group publishes “[Rapid DNA Testing for non-CODIS uses: Considerations for Court](#)” on FBI.gov. This product of the non-CODIS Best Practices Task Group is a follow-up document to the “*Non-CODIS Rapid DNA Considerations and Best Practices for Law Enforcement Use*” and provides valuable guidance for the use of Rapid DNA for court purposes.

3.2. Future Vision of Rapid DNA Integration for Crime Scene Sample Analysis and CODIS

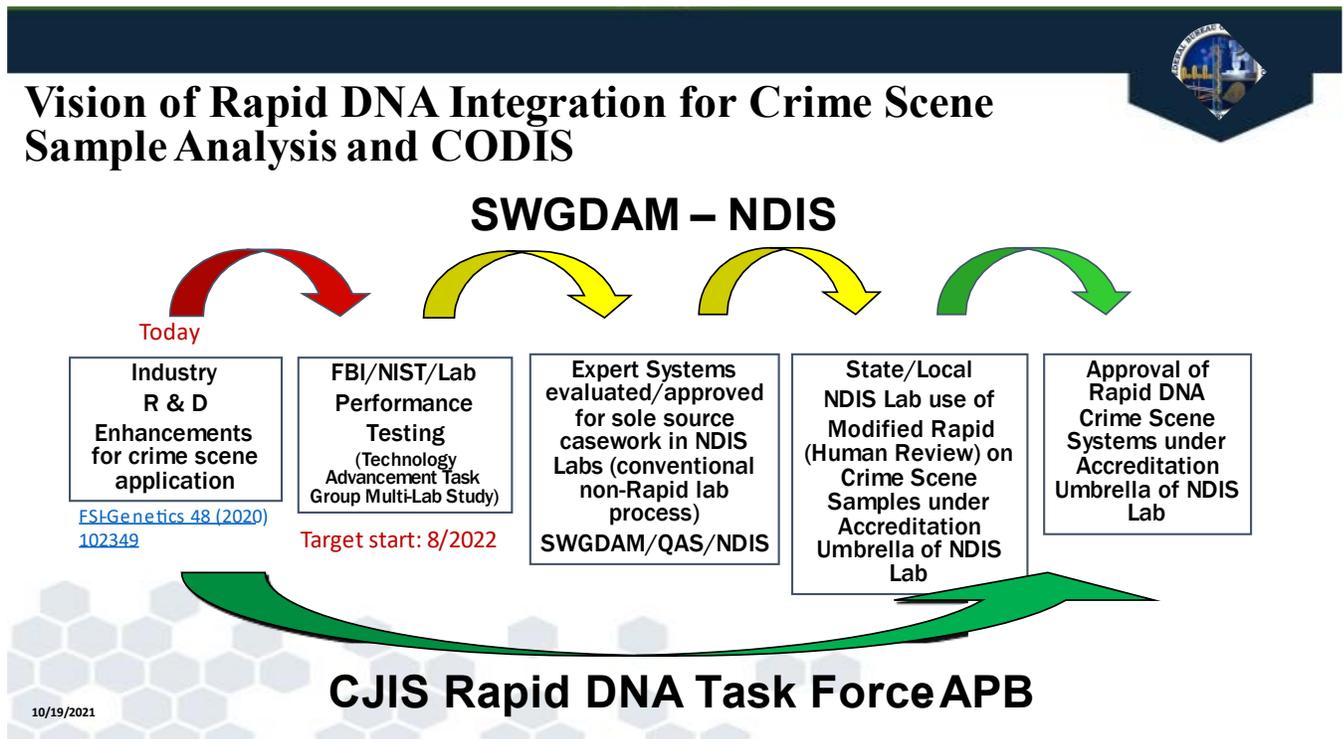


Figure 2: This graphic represents the FBI's future vision to integrate Rapid DNA for crime scene sample analysis and CODIS. With the help of our external partners on the Technology Advancement Task Group, the Scientific Working Group on DNA Analysis Methods (SWGDM), the NDIS Operational Procedures Board and the CJIS Advisory Policy Board Rapid DNA Task Force, the FBI will monitor the maturity of the Rapid DNA technology for future crime scene sample analysis for CODIS. Industry is currently making the required enhancements to the Rapid DNA technology outlined in the July 2020 joint position statement by leading scientists in the United States and Europe ([Forensic Science International: Genetics 48 \(2020\) 102349](#)). Once enhancements are complete, the Technology Advancement Task Group will coordinate a multi-laboratory study to look at the capabilities and limitations of the improved Rapid DNA technology. The study is targeted to begin in August of 2022 but is dependent on manufacturer readiness. Data from this study must support the use of the improved Rapid DNA technology on crime scene samples for the Technology Advancement Task Group to make recommendations to SWGDAM. SWGDAM will be required to make changes to the FBI's Quality Assurance Standards to allow for the use of Rapid DNA on crime scene samples and development of crime scene Rapid DNA programs under the accreditation umbrella of the CODIS laboratory. Initially, the data developed from crime scene samples will need to be interpreted and reviewed by qualified DNA analysts in the CODIS laboratory while additional information is collected regarding the onboard expert systems and their ability to identify single source crime scene sample data.

As outlined in the July 2020 joint position statement by leading forensic scientists in the United States and Europe ([Forensic Science International: Genetics 48 \(2020\) 102349](#)), enhancements are needed before Rapid DNA is suitable for crime scene CODIS applications. The Advancement Task group continues to monitor the maturity of Rapid DNA and is making plans to evaluate the capabilities and limitations of the technology after enhancements are made. A list of milestones needed is below:

1. Rapid DNA technology improvements and data are needed ([Forensic Science International: Genetics 48 \(2020\) 102349](#)) for use on crime scene samples and CODIS.
 - a. Coordinated multi-laboratory study led by the Advancement Task Group to study the capabilities and limitations of the improved Rapid DNA devices, once improved devices are available (anticipated to begin in late 2022).
 - b. Data must support use of the improved Rapid DNA technology on crime scene samples for the Advancement Task Group to make recommendations to SWGDAM regarding the maturity of Rapid DNA for crime scene samples analysis and CODIS.

Milestones 2, 3 and 4 are dependent on data and completion of Milestone 1

2. Development of a Crime Scene Rapid DNA Program that is covered under the accreditation umbrella of a CODIS laboratory provides the quality structure needed to:
 - a. Dramatically increase the capacity of an accredited CODIS laboratory by increasing the number of trained technicians available (remote processing).
 - b. Address the need for qualified DNA analyst data review required for crime scene sample data.
 - c. Provide ability to search crime scene Rapid DNA profiles in CODIS.

3. Development of Rapid DNA Standards and Procedures for crime scene sample and CODIS use as outlined in the Rapid DNA Act of 2017.
4. Approval of Expert Systems for crime scene sample use.
 - a. The Forensic DNA Casework Expert Systems Working Group of SWGDAM is developing guidance in this area for use with single source crime scene samples in an accredited DNA laboratory.
 - b. Lessons learned from accredited laboratory use can be applied to Rapid DNA in the future for the automated interpretation of single source crime scene samples.

The FBI is dedicated to facilitating the advancement of the Rapid DNA technology in order to ensure its reliable, responsible and appropriate implementation for crime scene and CODIS use.

4. Disaster Victim Identification and Body Identification

When DNA is needed in body identification or disaster victim identification (DVI), the use of Rapid DNA can help speed the identification process. It is critical to involve laboratory personnel and the medical examiner/coroner in setting up an identification program. Identification should be a coordinated effort as expertise is needed during the identification process.

Identification requires a comparison of an unidentified human remain to some sort of reference sample. A direct reference sample is a sample that can be verified as coming directly from the missing person or deduced as coming from the missing person. Some examples of verified and deduced reference samples can be seen below:

Verified Direct Reference Sample (preferred)	Clinical biopsy sample Clinical blood sample Newborn screening sample Mouth swab from identification kit
Deduced Direct Reference Sample	Toothbrush Razor Eyeglasses Jewelry

If a direct reference sample is not available, it is important to collect reference samples from biological relatives of the unidentified/missing person. Two or more biological relatives should be collected whenever possible as genetic comparison to biological relatives can be complex. Documentation of the exact biological relationship and consent for using a biological relative sample for comparison is necessary. Primary biological relatives are the best for comparison and are preferred. Secondary relatives should only be collected when two primary relatives are not available.

Primary Biological Relatives (preferred)	Biological Parents Biological Children Biological Siblings
Secondary Biological Relatives	Biological Aunts Biological Uncles Half-Siblings Biological Grandparents

It is recommended that body identification or DVI programs outside an accredited laboratory follow the [Non-CODIS Rapid DNA Considerations and Best Practices for Law Enforcement Use](#).

It is important to note that if the unidentified human remains or the family reference sample(s) should ever be placed in the National Missing Persons Database of CODIS, the samples must be worked in an accredited laboratory following the FBI’s Quality Assurance Standards. CODIS laboratories can add additional locations under their scope of accreditation to process family reference samples via Rapid DNA outside the physical laboratory. This may be possible for unidentified human remains once the requirements of section 3.2 “*Future Vision of Rapid DNA Integration for Crime Scene Sample Analysis and CODIS*” are met.

5. Rapid DNA in an Accredited Laboratory

The Forensic and Database Quality Assurance Standards for accredited DNA laboratories address the use of Rapid DNA in the laboratory setting for known, database or casework reference samples. CODIS eligible reference samples can be uploaded into CODIS as well as the national level of CODIS, NDIS. Please see the [NDIS Operational Procedures Manual](#) for more details and necessary requirements.

CODIS laboratories can add additional locations under their scope of accreditation to process casework reference samples via Rapid DNA outside the physical laboratory.

5.1. Benefits of Laboratory Rapid DNA Use

Integration of Rapid DNA for reference mouth swabs in the laboratory has many benefits. These benefits include, but are not limited to:

- Reference sample mouth swabs can be easily analyzed using a separate and faster workflow from evidence samples
- Forensic DNA analysts can focus on crime scene evidence samples
- Suspect and elimination samples submitted after the evidence in the case doesn’t disrupt the forensic DNA analyst’s examination plan
- DNA data from suspect and elimination samples are quickly available for comparison in the case

6. Law Enforcement FAQs Regarding Rapid DNA

1. What is Rapid DNA?

Rapid DNA, or Rapid DNA analysis, is a term used to describe the fully automated (hands free) process of developing a DNA profile from a reference sample mouth swab in 1-2 hours without the need of a DNA laboratory and without any human interpretation. Rapid DNA devices were originally designed for operation in booking stations to enroll and search an arrestee's CODIS profile during the booking process. This technology has the potential to dramatically impact law enforcement's ability to generate investigative leads while an arrestee is still in custody. Ultimately, Rapid DNA in the booking station has the potential to prevent additional crimes from being committed by that individual, resulting in safer communities.

2. What is the DNA Index of Special Concern, or DISC?

The DISC is a watchlist of DNA profiles from unsolved cases (homicides, sexual assaults, kidnapping and terrorism cases) that will be searched immediately every time an arrestee sample is successfully processed in a Rapid DNA device located in a booking station. This will enable law enforcement to detain these individuals during the booking process should a match be made to an unsolved crime scene sample in the DNA watchlist. DISC profiles are searched at the state and national level.

3. What is the Rapid DNA Act of 2017 and what does it mean to law enforcement?

The Rapid DNA Act of 2017 created a bridge that will now allow qualifying DNA profiles that are developed in an approved Rapid DNA device to be enrolled into CODIS. Previously, DNA had to be developed in an accredited laboratory by a trained scientist with degree requirements. The law now allows the FBI to create a path for DNA profiles to be put into CODIS directly from these devices.

4. Does a Rapid DNA device produce a full CODIS eligible DNA profile?

A Rapid DNA device can produce a full CODIS eligible DNA profile from a reference mouth swab about 85-90% of the time. If a sample does not produce a full CODIS eligible DNA profile, a second sample must be attempted or submitted to the laboratory for analysis. Please consult your laboratory to determine the best option for your situation.

5. How much training is required to use a Rapid DNA device?

Rapid DNA devices have been designed to be operated by non-laboratory personnel, i.e., law enforcement personnel. Only minimal training is required to operate a Rapid DNA device. The training required is similar to the training needed to operate a LiveScan fingerprint device.

6. How many samples can be processed by a Rapid DNA device?

Sample capacity varies from device to device but ranges from 1 sample per run to 5 samples per run.

7. Can Rapid DNA devices be used on crime scene samples for CODIS?

Not at this time. Currently available Rapid DNA devices were specifically developed for reference sample mouth swabs taken from persons during the booking process. Reference sample mouth

swabs contain pristine DNA which makes them ideal for this application. Crime scene samples routinely do not contain pristine DNA and are therefore precluded from being processed using a Rapid DNA device for CODIS purposes at this time.

It is important to note that there seems to be a potential triage role for Rapid DNA. Using a Rapid DNA device to triage crime scene samples would require the collection of duplicate samples ([A-Swab / B-Swab](#)). One sample (A-Swab) would be collected for submission to the forensic laboratory for analysis using current DNA technology. A second sample (B-Swab) would be collected and could be analyzed immediately using the Rapid DNA device in the field for investigative or triage purposes. Only the results from the accredited forensic laboratory analysis would be used for upload and/or search in CODIS and for court testimony purposes. See [Non-CODIS Rapid DNA Considerations and Best Practices for Law Enforcement Use](#) and [Rapid DNA Testing for non-CODIS uses: Considerations for Court](#) for more information.

8. How could Law Enforcement utilize Rapid DNA for CODIS?

There are three main opportunities for the law enforcement community to utilize Rapid DNA for CODIS.

- The first is the use of Rapid DNA in an accredited laboratory. This is already a reality as there are NDIS approved Rapid DNA Systems that a forensic laboratory can use for known reference mouth swabs and qualifying samples can be enrolled in CODIS/NDIS.
- The second is the use of Rapid DNA technology in the booking station environment for the processing of a qualifying arrestee sample.
- The third opportunity is the potential use with crime scene samples for enrollment and searching in CODIS, which is perhaps the most challenging scenario and represents a long-term strategy. The FBI is currently working with other Federal, State and Local law enforcement partners as well as the Rapid DNA industry to help advance this technology as it relates to the processing of casework samples.