**A Partnership Approach to the Deployment of Rapid DNA Technology in Ontario**

**October 2024**

## Introduction

Rapid DNA technology can produce DNA profiles in under two hours, offering the potential to significantly benefit police investigations and human remains identifications. It is becoming increasingly prevalent and impactful, globally, in various applications.

Due to the widespread interest in Rapid DNA technology amongst police and death investigators across the province, and recognizing its strong investigative potential, the Centre of Forensic Sciences (CFS) has partnered with five Ontario police services as well as the Ontario Forensic Pathology Service (OFPS) / Office of the Chief Coroner (OCC) to pilot this technology in the hands of trained, non-laboratory users. The purpose is to ensure consistent, appropriate use both now and in the future with the anticipated wider future roll-out of Rapid DNA services.

The purpose of this document is to provide an overview of the technology, its assessment and validation by the CFS, and how it is used in pilot programs administered by the CFS.

## Technology Background

A 'Rapid DNA' system includes a specially designed instrument and its associated software, which allows for the generation of DNA profiles from biological samples in under two hours, with minimal human intervention. Developed to provide fast and accurate DNA analysis at non-laboratory locations, the system is designed to be user-friendly and operated by non-DNA experts. Rapid DNA technology has many different applications. For example, it can be used to develop profiles from crime scenes, on-site either at police facilities or in forensic laboratories. Likewise, the international community has found the technology useful at mass fatality incidents to aid in human remains identification.

Rapid DNA technology is not a replacement for DNA testing in an accredited forensic laboratory and cannot accommodate the full range and variability of sample types and quality encountered in forensic casework. It works optimally with samples that originate from a single donor, with high quantities and quality of DNA. Samples with low levels of DNA are much less suitable, as the sensitivity of this technology is lower than that of traditional DNA laboratory detection systems. Samples containing mixtures of DNA from more than one person, commonplace in forensic science, are also not suitable for Rapid DNA testing. Results from Rapid DNA systems are intended to provide investigative information in a timely fashion, rather than to produce admissible DNA evidence in courts of law. Furthermore, profiles developed through the use of Rapid DNA technology cannot be searched against, or uploaded to, Canada's National DNA Data Bank (NDDB).

It is critical that use of this frontline technology incorporates all appropriate quality assurance measures to ensure its long-term success as a complement to forensic DNA testing in an accredited laboratory. Key considerations include, but are not limited to:

- Validation and training
- Suitable sample types and their collection
- Operation and maintenance of Rapid DNA instruments
- Rapid DNA test results and their use
- Duplication of Rapid DNA results through traditional DNA testing by the CFS, where necessary for court

As it considers a provincial model for the deployment of Rapid DNA technology, the CFS has taken these factors into account in the frameworks developed for pilot projects.

**Technology Assessment and Validation**

The CFS was an early adopter of first-generation Rapid DNA technology, procuring a system in early 2015. Following validation, it was implemented in-house to process select reference samples only. It was discontinued, however, in 2018 due to recurring technical issues.

Since that time, there have been a number of improvements in Rapid DNA technology, including the development of a new generation of instruments. In 2020 the CFS evaluated systems from the only two companies presently manufacturing them and concluded that both were suitable for renewed consideration. Shortly thereafter, the CFS procured and validated a new Rapid DNA system, the *ANDE™ 6C Rapid DNA Analysis™ System* (ANDE[1]). The CFS has also purchased the *Applied Biosystems™ RapidHIT™ ID System* (RHID[2]), with validation planned for the near future.

The CFS' validation of ANDE, performed by its experts in accordance with industry best practices and the *Modified Rapid DNA Internal Validation Guidance Module for Single Source Samples* set out by the US-based Scientific Working Group on DNA Analysis Methods (SWGDAM), assessed the system's ability to reliably generate a robust and accurate DNA profile, using 148 different samples. Testing criteria included, but was not limited to:

- accuracy and precision (does the instrument reliably and reproducibly generate correct DNA profiles),
- sensitivity (what are the lower and upper limits of input DNA),
- contamination (is there any inter- and intra-run contamination),
- mixture studies (does the instrument software reliably flag samples which include DNA from more than one person),
- instrument software capabilities (does the software enable the appropriate outcomes, i.e. exclusion vs match, when two Rapid DNA profiles are compared. In the case of decedent identifications, does the software's available kinship assessment tools reliably calculate the appropriate likelihood ratios when samples from human remains are compared to reference samples from putative family members)

[1] The ANDE system can accommodate running 4-5 samples simultaneously, depending on configuration.
[2] The RHID system can only accommodate running a single sample at a time.

Sample types tested during the validation included those that are routinely collected for forensic DNA identification (e.g. blood, semen and saliva) on various substrates as well as those sometimes necessary to confirm decedent identifications (e.g. teeth and muscle tissue). Bone samples have yet to be successfully validated.

CFS validation demonstrated that the ANDE system is suitable for its use in the pilot programs, when operated by CFS-trained forensic pathology / police specialists, under the conditions and per the policies and procedures defined by the CFS. The ANDE system and the RHID System have also both been subject to various other validations outside the CFS.[a-d]

**Pilot Projects**

The CFS has initiated two pilot projects to use rapid DNA technology in non-criminal death investigations and in criminal investigations.

Beginning in April 2022, the first pilot project allowed trained OFPS staff to use Rapid DNA as a tool to assist pathologists/coroners in confirming presumptive identities of deceased persons in non-criminal death investigations.

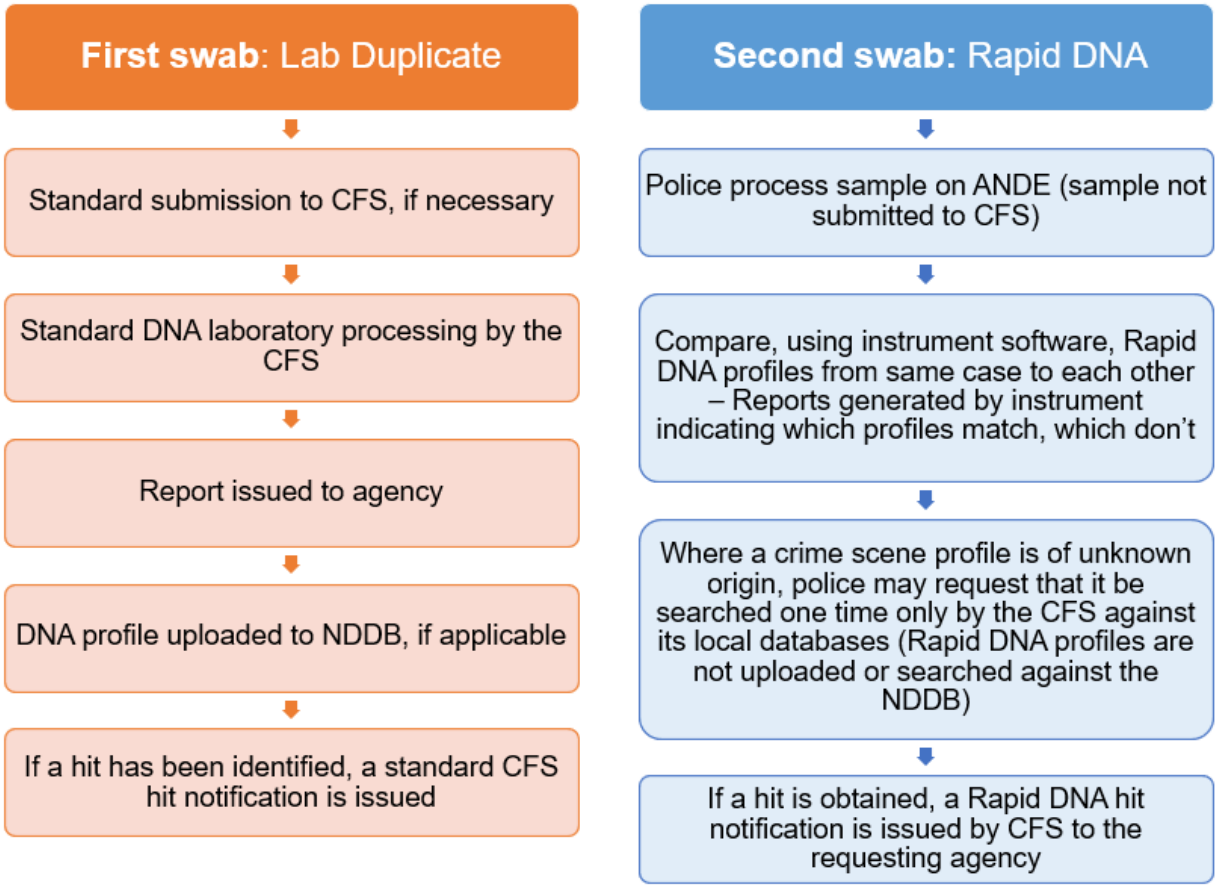
Beginning in March 2023, the second pilot project allowed for trained police officers to use Rapid DNA to generate DNA profiles that will assist in expediating police investigations. Additionally, the technology can be used as a screening tool to triage samples for submission to the laboratory. Both pilots will ultimately help inform how best to develop and implement a wider provincial Rapid DNA program.

Police Pilot Project

All DNA samples processed as part of the police pilot project are collected in duplicate to permit, where necessary, subsequent laboratory testing of the same samples at the CFS. Duplicate samples are collected sequentially, with the first sample reserved for CFS laboratory testing, and the second sample used for Rapid DNA testing. Only those results generated and reported by the CFS using its traditional testing methods, and in accordance with its standard policies and procedures, will be relied on for court purposes.

Police may use Rapid DNA testing to generate and compare DNA profiles within the same case and they may, where a profile is of unknown origin, request that it be compared by the CFS to other DNA profiles housed on its local DNA database. Figure 1 below outlines the processes involved.

Figure 1: Workflow of police pilot project using ANDE




The CFS aims to develop a formalized provincial program, with consistent application of the technology, within a defined quality framework, that considers both scientific and legal best practices. Currently, Rapid DNA instruments are accessed at the CFS facility in Toronto by pilot project participants. After further analysis of the pilot project, it is anticipated that Rapid DNA instruments will be operated outside of the CFS laboratory environment, with CFS providing on-going support with respect to establishing and monitoring the quality framework, training, technical support and access to local databases.

In January 2024, the Canadian SWGDAM published *Interim Guidance for Rapid DNA Testing by Police Agencies*. Though that guidance is aimed at police services opting to deploy Rapid DNA testing independently of their accredited forensic DNA testing laboratory, the pilot project framework established by the CFS conforms with that guidance.

At this time, select members of the Ontario Provincial Police, Toronto Police Service, Hamilton Police Service, York Regional Police Service, and Peel Regional Police Service have been trained to use Rapid DNA technology in accordance with the pilot framework. Within that framework the CFS is responsible for:

- Initial validation of Rapid DNA technology to ensure that, when properly used, it is suitable for its intended purpose

- Defining restrictions on the use of Rapid DNA technology by participating pilot partners, as supported by the validation
- Training of non-CFS personnel, designated by pilot partners, to operate Rapid DNA instrumentation (including considerations with respect to the collection of samples for Rapid DNA testing)
- Training of non-CFS personnel, designated by pilot partners, with respect to the collection of samples for Rapid DNA testing
- The provision of technical support and advice to pilot partners
- Chairing a working group, comprised of pilot partners and Crown counsel from the Ministry of the Attorney General (MAG), Criminal Law Division to discuss legal considerations and best practices concerning Rapid DNA use
- Assessing the overall effectiveness of the pilots and developing recommendations for a provincial model for Rapid DNA testing

Partner police agencies are responsible for undergoing required training and identifying appropriate cases and samples that would benefit from Rapid DNA, and for following the policies and procedures outlined by the CFS in the collection of samples and the operation of Rapid DNA instruments.

The pilot is expected to continue into 2025/2026 and include an incremental expansion and assessment of different elements to track progress, address challenges, and make informed decisions. Key areas of expansion may include deployment of the instruments outside of the CFS.

**Conclusion**

The CFS is committed to supporting frontline officers and clients with emerging technologies as it continues to advance the deployment of Rapid DNA technology in Ontario. Through ongoing engagement with our pilot partners and collaboration with the Ministry of the Attorney General (MAG), Criminal Law Division, we are coordinating efforts and ensuring the adoption of best practices from both investigative and legal perspectives.

The pilot projects serve as valuable platforms for gathering insights and refining our approach towards implementing a provincial program that integrates frontline users with the expertise of the CFS. By leveraging Rapid DNA technology alongside traditional laboratory testing, we aim to enhance the efficiency of forensic investigations while upholding the highest standards of evidentiary integrity for court proceedings.

## References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