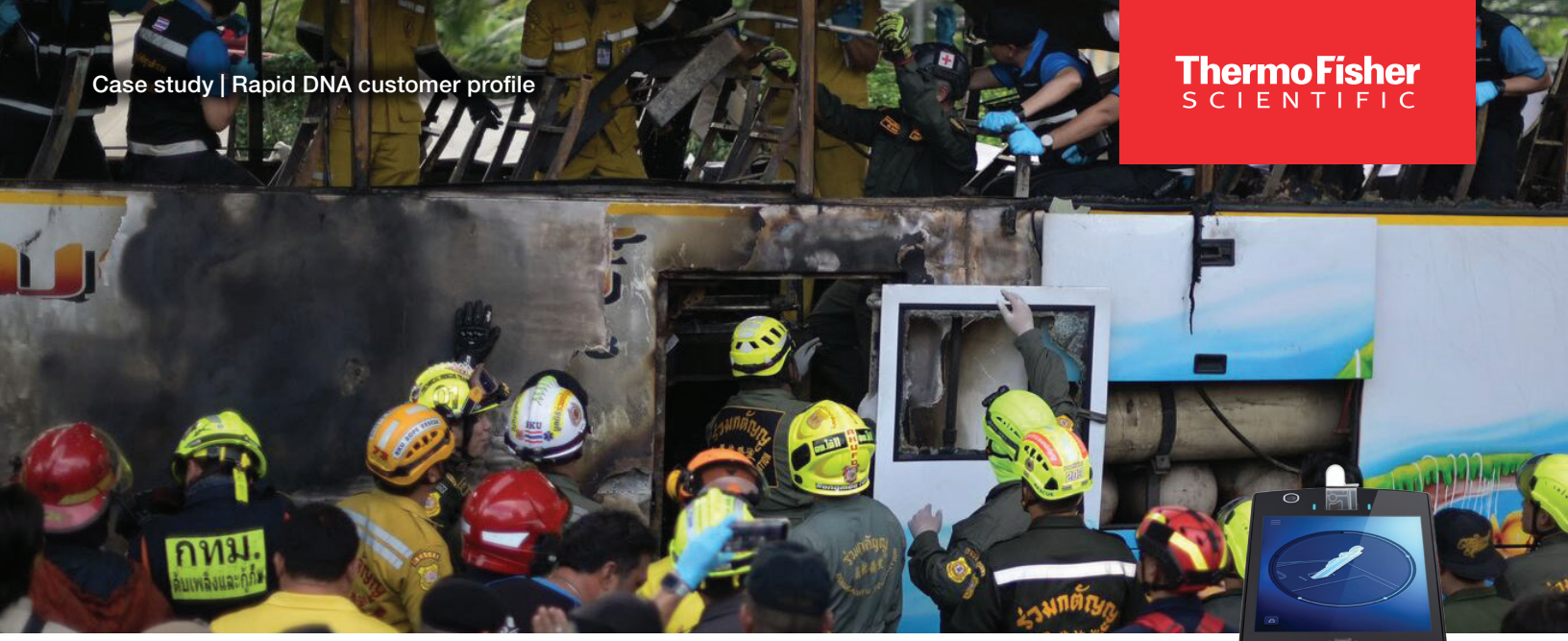


Rapid DNA in disaster response: A case study in collaboration, accuracy, and speed

Collaborations set a new standard in victim identification.

Summary

- This case study examines the use of Rapid DNA technology in disaster response after a school bus accident in Thailand.
- The Institute of Forensic Medicine and the Central Police Forensic Science Division deployed the Applied Biosystems™ RapidHIT™ ID system, enabling identification of victims within 24 hours.
- The results highlight how Rapid DNA helps accelerate victim identification, enhances accuracy, and optimizes resources—setting a model for future mass casualty response.

Introduction

In Thailand, the Royal Thai Police plays a central role in managing disaster and emergency situations. Typically, local police are responsible for the initial response, coordinating with relevant units to investigate the scene, determining the cause of the incident, and collecting physical evidence. In general forensic cases, the Forensic Science Division handles the crime scene investigation and evidence analysis, while the Institute of Forensic Medicine, Police General Hospital, conducts the medical examination and identification of the deceased. However, in disaster victim identification (DVI) cases—especially those involving mass casualties—both organizations work in close collaboration to support identification efforts are carried out quickly, accurately, and in accordance with international DVI guidelines. The identification process can involve:

- Fingerprint analysis
- Dental record comparison
- Physical examination of the bodies
- DNA profiling

Integrating DNA profiling into the identification process enhances accuracy and efficiency, providing reliable results even when other methods are inconclusive or unavailable.

Overview

On October 1, 2024, a school bus was heading for a field trip to Bangkok from Uthai Thani Province carrying 44 passengers – 38 students and 6 teachers. An explosion of the right front tire caused the bus to lose control and crash into a roadside barrier. A fire broke out in the lower section of the bus, which was powered by compressed natural gas (CNG). Of those on board, 18 students and 3 teachers escaped. The remaining 23 passengers, 20 of which were students, were later confirmed dead. It was discovered that the bus had been modified to run on compressed natural gas, with eleven gas tanks on board- five more than the standard allowed. A gas leak was believed to have caused rapid fire spread. With an electrically operated door system, the doors remained locked, preventing people inside from opening them. There was no bus assistant, and the teachers responsible for the students had not received any training. Claiming 23 victims, this became one of Thailand's deadliest traffic accidents, profoundly impacting many lives.

Responding to the tragedy

Within the same day, on October 1, between 17.00-18.30, all 23 victims' bodies were moved to the Police General Hospital (PGH). Due to the severity of the fire, and the condition of the bodies, traditional methods of identification were insufficient.

The Royal Thai Police ordered the establishment of a ***disaster victim identification operations center to facilitate the identification process.***

The victim identification process involved two simultaneous steps:

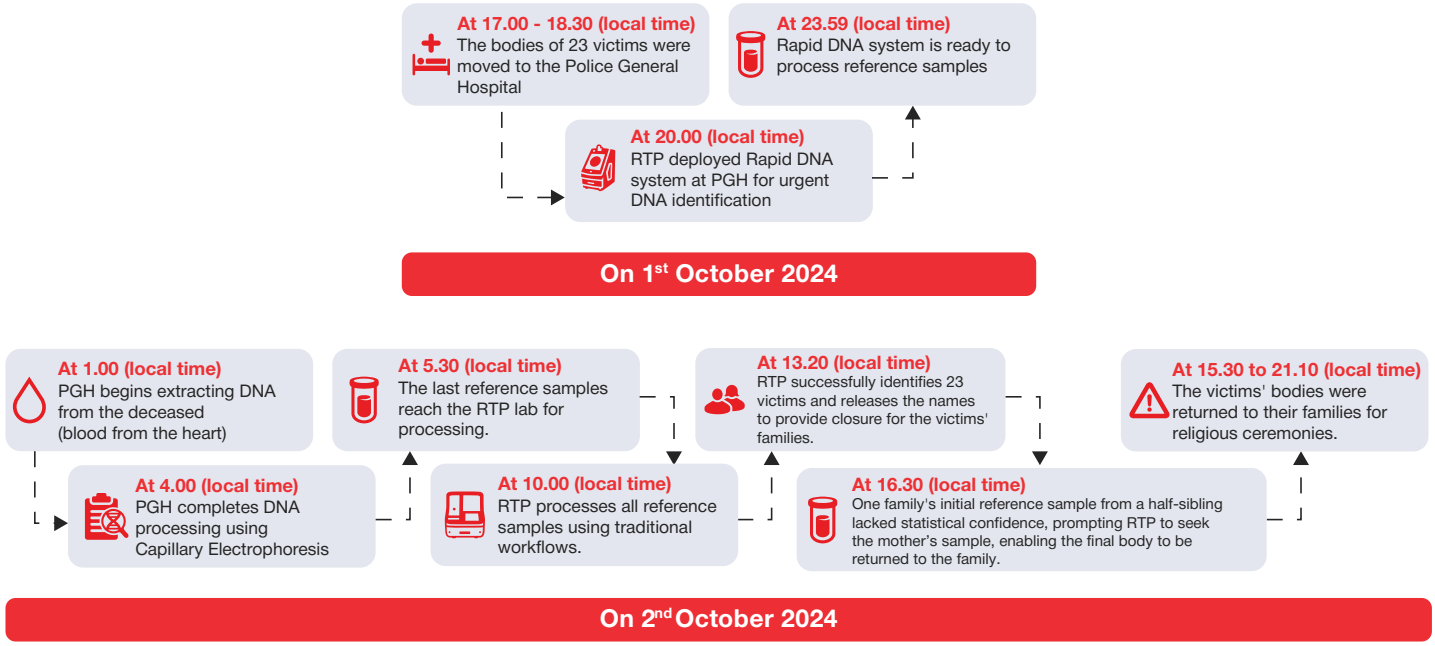
- The operations center gathered experts the from DVI sub-division, Biology and DNA sub-division, and Latent fingerprint sub-division from Central Police Forensic Science Division who worked together to collect evidence for verifying identity of the victims. The entire process, which included autopsies, body preparation for identification, and collaboration with rescue workers, emergency medical teams, and forensic teams, to expedite the identification of the deceased, was a race against time.

- Simultaneously, the Royal Thai Police contacted the victims' families for DNA samples. Families were transported to the Police General Hospital Operations Center to provide family DNA reference samples.

- Within 24 hours, the forensic team identified the 23 victims and returned them to their families, providing some solace during this difficult time.

Sign directing relatives to the family assistance center: Relatives of the victims of the school bus fire, please proceed to the 3rd floor. For inquiries, please call 02-207-6108 ext. 1101

Timeline of laboratory workflow for victim identification:



Within 24 hours, the bodies of the deceased were moved and handed over to the families for funeral rites.

To meet the urgent timeline, DNA analysis methods were tailored by sample type:

Postmortem samples:
Biological samples collected from deceased individuals, typically blood withdrawn directly from the heart, were processed using the conventional forensic DNA workflow. This involved the following sequential steps:

- DNA extraction - Whole blood DNA extraction with QIAamp™ Blood Mini Kit
- DNA quantification - Applied Biosystems™ Quantifiler™ HP DNA Quantification Kit on Applied Biosystems™ 7500 Real-Time PCR System for Human Identification
- STR amplification - Applied Biosystems™ Verifiler™ Plus PCR Amplification Kit on Applied Biosystems™ ProFlex™ Thermal Cycler
- Capillary electrophoresis using Applied Biosystems™ 3500XL Genetic Analyzer

Reference samples (batch processing):
To streamline the workflow for reference samples submitted in groups, buccal swab specimens were processed using a direct PCR approach. This method bypassed DNA extraction and quantification, and included the following steps:

- Sample collection using buccal swab
- Cell Lysis with Applied Biosystems™ Prep-n-Go™ Lysis buffer
- STR Amplification with Applied Biosystems™ GlobalFiler™ IQC kit on Proflex Thermal Cycler
- Capillary electrophoresis using Applied Biosystems™ 3500XL Genetic Analyzer

Reference samples (single or small volume submissions):
For reference samples submitted individually, a Rapid DNA workflow was employed to accelerate processing. This automated method integrated the key steps—lysis, amplification, separation, and detection—into a single streamlined process, enabling rapid generation of DNA profiles.

Identification results

- 1 victim identified by a wedding ring
- 3 by fingerprints
- 12 by DNA
- 7 by both fingerprints and DNA
- 1 by dental examination

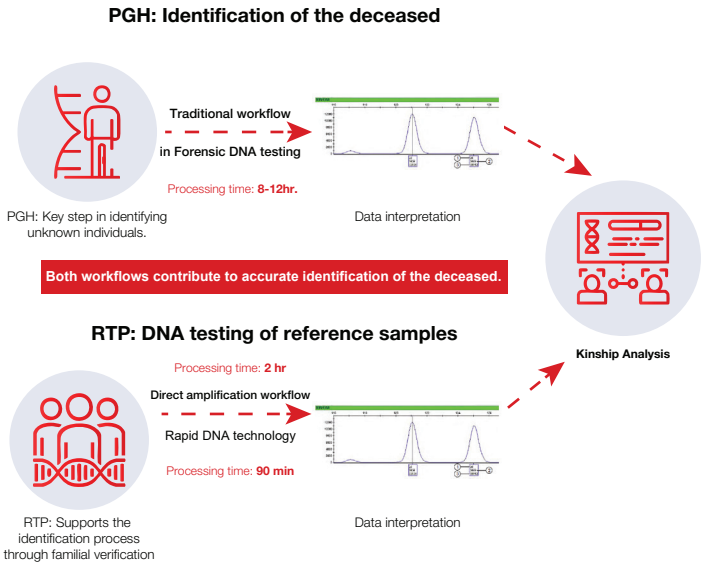
Technology impact on response time
Traditionally, full forensic workflows take days, especially with large sample volumes. The use of traditional forensic DNA workflow together with RapidHIT ID reduced processing time.

Challenges

One case required extra effort, beginning with a half-sibling reference sample that produced low statistical confidence and delayed identification. To improve accuracy, police contacted the child's mother and arranged for her transport from Uthai Thani Province to the Police General Hospital Operations Center in Bangkok. Her DNA was analyzed using the RapidHIT ID DNA system at 4:30 p.m., and within 90 minutes, a match confirmed her as the biological mother. The final body was then immediately released to the family.

Learnings and considerations

- Coordinating the identification efforts across two laboratories: the Police General Hospital Institute of Forensic Medicine and the Central Police Forensic Science Division, facilitated the identification within a remarkably short time.
- The Central Police Forensic Science Division was focused on collecting and processing reference samples from relatives. Buccal swabs samples collected from family members were analyzed using the Direct PCR process and Rapid DNA technology generating reference DNA profiles within 2 hours.
- The Police General Hospital Institute of Forensic Medicine analyzed blood withdrawn from the deceased, which required full workflow from DNA extraction, DNA Quantification, DNA Amplification, and Capillaries Electrophoresis.



Conclusion

The Bangkok bus fire will be remembered for its loss, but also for the response that followed. Through the Emergency Response teams' rapid mobilization, interagency collaboration and the use of advanced technology significantly reduced the time required to identify victims, minimizing the emotional toll on affected families. This case underscores how preparedness, coordination, and technological integration offer a model for timely, accurate disaster victim identification, and restoration of community resilience.

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