MASTER FORENSIC SCIENCE – RESEARCH PROJECT

Title	: The persistence of perchlorate traces from flash powder
Keywords	: Persistence, flash powder, perchlorate, explosives
Forensic Expertise Area	: Forensic chemistry
Start Date	: January 2026 (can be discussed)
Host Institute	: Netherlands Forensic Institute
Department/Team	: Explosions & Explosives
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Short Description

In recent years, the number of explosive attacks in the Netherlands has sharply increased, with flash powder now being the most commonly used material in these incidents. Previous studies within the EU-funded INHERIT (INHibitors, Explosives, and pRecursor InvesTigation) project [1] have examined the prevalence, transfer, and recovery of perchlorate originating from flash powder [2-7]. This knowledge supports activity-level interpretation of perchlorate traces. However, data on the persistence of these traces is still very limited. As our intern, you will have the opportunity to help address this knowledge gap, within the Explosions & Explosives (E&E) team of the Netherlands Forensic Institute (NFI). In doing so, you will gain valuable scientific and laboratory experience while directly contributing to a safer society.

You will join a diverse team of specialists who work daily on both forensic casework and research and development activities. The E&E team investigates cases involving explosive devices and illegally used fireworks, such as hand grenade threats, ATM theft, and homemade bombs. The composition of intact explosives, the effects of ignition, and the cause of explosions are investigated. With self-developed methods, the team can analyse the smallest explosive traces with high reliability and provide forensically strong conclusions in their reports. This is achieved in close collaboration with the Defence Explosive Ordnance Disposal (EOD) service, the Justice Department, and the police.

Your main focus will be designing scientifically sound experiments to determine the persistence of perchlorate traces from flash powder, for example, on human hands. Preliminary results from a previous student will be your starting point. The data you collect should be suitable for implementation in Bayesian Networks, thereby supporting

more informed activity-level interpretation of perchlorate traces. All experimental work, including sampling and analytical procedures, will be conducted at the NFI.

Key References

1) Cordis. 2021. INHibitors, Explosives and pRecursor InvesTigation. https://cordis.europa.eu/project/id/101021330. Doi: 10.3030/101021330
2) Assessing the abundance of pyrotechnic traces from New Year's Eve celebrations in the Netherlands: implications for forensic explosives investigations. Irene M. van Damme, Annemieke W.C. Hulsbergen, Shari Allers, Karlijn D.B. Bezemer, Arian C. van Asten. *Propellants, Explosives, Pyrotechnics* 2024*, 50(1),* e202400118. DOI: 10.1002/prep.202400118.
3) A study into the natural occurrence of inorganic ions relevant to forensic explosives investigations on human hands. Irene M. van Damme, Annemieke W.C. Hulsbergen, Shari Allers, Karlijn D.B. Bezemer, Jason V. Miller, Arian C. van Asten. *Forensic Science International* 2024*, 361,* 112-119. DOI: 10.1016/j.forsciint.2024.112119.

Note: references 4-7 are not yet published, but submitted or prepared for submission, and can be provided to you when you start the research project.

4) *A novel approach to forensic explosives analysis: Studying perchlorate trace transfer from flash powder for activity-level interpretation. Irene M. van Damme, Marre E. Corver, Chivany S. Soemai, Sofie Lazeroms, Selma J.C. Wagemakers, Shari Allers, Karlijn D.B. Bezemer, Bas Kokshoorn, Annemieke W.C. Hulsbergen, Arian C. van Asten. Under review for publication in Forensic Science International.*
5) *Prevalence of explosives traces in police and civilian cars: Critical implications for perchlorate detection in forensic investigations. Irene M. van Damme, Nasrin Rezai, Joy Bodde, Remy Smolenaers, Shari Allers, Karlijn D.B. Bezemer, Lauren Lessey, Matthew S. Beardah, Tilo D. Schachel, Ragnhild Ueland, Bart Simoens, Annemieke W.C. Hulsbergen, Arian C. van Asten. In preparation.*
6) *The flash-powder bomb factory: Part I. Transfer and persistence of perchlorate at the manufacturing site. Irene M. van Damme, Marre E. Corver, Selma J.C. Wagemakers, Shari Allers, Karlijn B.D. Bezemer, Annemieke W.C. Hulsbergen, Arian C. van Asten. In preparation.*
7) *The flash-powder bomb factory: Part II. Danger assessment of full-scale IED explosions reconstructed from forensic casework scenarios. Shari Allers, Annemieke W.C. Hulsbergen, Irene M. van Damme, Karlijn B.D. Bezemer, Arian C. van Asten. In preparation.*

Required/Recommended skills and expertise

We are looking for a motivated and creative Forensic Science master's student with an interest in experimental design and, preferably, a solid background in analytical chemistry and statistics. You should be able to work independently, show initiative, and

contribute your own ideas, while also collaborating effectively and asking (critical) questions when needed.
We value precision, transparency, and a strong scientific approach. The research must be both reproducible and repeatable. The preferred start date for this project is January 2026, with a total duration of six months, but alternative timelines can be discussed.

Visuals