

**Project Title:** Investigation into error rates for distance estimation work

**Principal Investigator:** SallyAnn Harbison (The Institute of Environmental Science and Research Ltd., & School of Chemical Sciences, The University of Auckland)

**ESR Supervisor:** Leah Tottey (The Institute of Environmental Science and Research Ltd.)

**Student Researcher:** Skye Gallagher (MSc Candidate in Forensic Science, School of Chemical Sciences, University of Auckland)

**Funding:** The Institute of Environmental Science and Research Ltd.

## **PARTICIPANT INFORMATION SHEET (PIS)**

This is an invitation to participate in a University of Auckland Master of Science research project, in collaboration with the Institute of Environmental Science and Research Ltd. (ESR) in Mount Albert, Auckland. It is entirely your choice whether you participate. If you wish to not participate, you do not have to provide a reason and if you do wish to participate, you may withdraw from the study at any time.

This PIS should help you make an informed decision about participation. It outlines the reasoning behind this project, what your participation entails, what the benefits and risks might be, and what would result when the project is concluded. You may wish to consult with other people such as your whānau/family before you make your decision.

If you do wish to take part in this research, you will be asked to sign the consent form (CF) attached to the invitation email. You will be given a copy of the PIS and CF for your safekeeping.

Your organisation's consent for you to use their facilities and resources to participate in this study is also required. If you wish to partake in this research but your organisation does not consent, you can no longer proceed with this study.

This document is 4 pages long. Please ensure you have read and fully understood the content of this document before you make your decision.

### **Background**

Scene reconstruction is an important role for firearm examiners. It can provide valuable evidence for the Court, such as the range, position, and orientation of a firearm when it was fired, and the position of a victim upon impact of the shot. In New Zealand, shotguns are amongst the increasingly popular type of firearms as they are permitted for sporting and hunting with a firearms license.

The cartridge of a shotgun, a shotshell, contains many metal pellets and upon discharge, these pellets spread in a cone-like fashion which makes it possible to estimate the muzzle-to-target distance based on the size of the pellet spread. There are several factors that may vary the spread such as barrel length, shot size, and the choke design on the shotgun. Firearm examiners

may carry out distance estimation work by making experimental shots at known distances to provide an estimated range of distance.

The shortfall of distance estimation work using pellet patterns is that firearm examiners currently do not have reference data, such as published literature, which acknowledges the examiner error rates for this type of distance estimation work. This project aims to provide those error rates based on the distance estimations of firearm examiners at ESR and internationally, which can be used when presenting expert evidence in Court. Error rates are important for measuring the validity and reliability of a scientific method, and several publications have recognised the lack of such documentation within forensic science.

For your interest, this project also aims to investigate the behavioural differences between lead and steel shot. The very general rule of thumb, being that a pellet pattern spreads one inch for every one yard of muzzle-to-target distance, is based on lead shot; however, lead shot is now prohibited for waterfowl hunting in many jurisdictions including New Zealand, and thus there has been an influx of steel shot seen in casework. This project will investigate the accuracy of current methods when applied to patterns created by steel shot and develop a new rule of thumb for examiners to use if the current one is found to be inaccurate.

### **Participant Procedure**

We are recruiting practicing firearm examiners to participate in this study.

As a voluntary participant, you will be given a physical pellet pattern created by the research team to estimate the muzzle-to-target distance.

You will be given a controlled amount of information to assist you, as an ideal case scenario would, such as the gauge of shotgun and pellet size. This will entail you to carry out several test shots to then provide the research team with a reportable distance range, as you would in a case scenario.

You will also be asked to fill out a questionnaire on Qualtrics to provide the research team with information regarding your professional experience and distance estimation protocol. Qualtrics is a secure, browser-based software for creating and distributing surveys. It is widely used for academic research and requires human ethics approval for use.

Your consent to participate in this research infers that you have professional experience as a practicing firearms examiner, and that you know the physical risks involved with your participation. This includes the risks imposed in a firing testing laboratory, notably the handling and discharge of firearms, the mitigation of lead toxicity, and other health and safety risks found within your workplace. You must be aware of who to contact in an adverse event (such as your health and safety committee) and you must contact the research team as soon as possible. You may benefit from the data obtained from this project as a practicing firearms examiner, and the research team hopes that the presentation of examiner error rates will give you confidence in the methods you apply in casework.

You may be sent a reminder about your participation in this study if you have not been in contact with the third-party representative within 60 days of receiving your physical pellet pattern.

### **Participant Rights**

The data obtained for this research will be used for the completion of the student's Master of Science thesis, and subsequent publications or conference presentations that may arise. As a voluntary participant, you have the right to withdraw from this study at any time, before the completion of this project (June 2025). If you choose to withdraw, your data will be destroyed. Consent forms will have restricted access and will be stored separately to the research data. Consent forms will only be accessible to the principal investigator for six years until the consent forms are destroyed per ESR protocol.

Any identifiable information provided will only be known to the third-party representative (Jessie Davys). Your identity will be de-identified for the research team with alphanumeric coding, and you cannot be linked to the data you provide. Your identity will not be published in the resulting thesis or subsequent publications, and the third-party representative will not share your identity with anyone. Only the third-party representative will have access to identifiable information, which will be stored in a secure location for a period of 6 years. After 6 years, the data will be destroyed appropriately.

Your decision regarding participation is completely voluntary and will not affect your relationship with the Institute of Environmental Science and Research Ltd. (ESR). This has been ensured in writing by the General Manager Forensic, John Bone of ESR.

Following the completion of this research project, the summary of the results will be available to all participants. You may request a copy by indicating as such on the consent form and providing an email address. Additionally, the results will be found in the master's thesis of Skye Gallagher, available at the University of Auckland library, and the ESR Library.

### **Cultural Beliefs**

You may hold cultural or spiritual beliefs about research and data collection. Issues that arise in association with your beliefs should be discussed with your whānau/family where you see appropriate. The research team acknowledges that individuals have the right to choose. If you are Māori or Indigenous and you wish for the research process to better suit your needs, please do not hesitate to contact any member of the research team (details listed below).

Thank you for taking time to read this participation information sheet and thank you for considering your voluntary participation in this research. If you have any further questions or concerns, please do not hesitate to contact any member of the research team (details listed below).

### **Contact Information**

#### **Principal Investigator: Dr SallyAnn Harbison**

The Institute of Environmental Science and Research, Mount Albert Science Centre, Auckland  
Private Bag 92021, Auckland

Email: [sallyann.harbison@auckland.ac.nz](mailto:sallyann.harbison@auckland.ac.nz) or [sallyann.harbison@esr.cri.nz](mailto:sallyann.harbison@esr.cri.nz)

#### **ESR Supervisor: Leah Tottey**

The Institute of Environmental Science and Research, Mount Albert Science Centre, Auckland  
Private Bag 92021, Auckland

Email: [leah.tottey@esr.cri.nz](mailto:leah.tottey@esr.cri.nz)

#### **Student Researcher: Skye Gallagher**

MSc Candidate in Forensic Science, University of Auckland

Email: [sgal101@aucklanduni.ac.nz](mailto:sgal101@aucklanduni.ac.nz) or [skye.gallagher@esr.cri.nz](mailto:skye.gallagher@esr.cri.nz)

#### **ESR Third-Party Representative: Jessie Davys**

The Institute of Environmental Science and Research, Mount Albert Science Centre, Auckland  
Private Bag 92021, Auckland

Email: [jessie.davys@esr.cri.nz](mailto:jessie.davys@esr.cri.nz)

#### **Academic Head of the School of Chemical Sciences: Professor Duncan McGillivray**

The University of Auckland  
Science Centre 302 (Building 302)  
22 Symonds Street, Auckland, 1010

Email: [d.mcgillivray@auckland.ac.nz](mailto:d.mcgillivray@auckland.ac.nz)

Approved by the University of Auckland Human Participants Ethics Committee on 28/03/2025  
for three years. Reference number 28965.

For any concerns regarding ethical issues, you may contact the Chair, the University of  
Auckland Human Participants Ethics Committee, Office of Strategy Research and Integrity,  
University of Auckland, Private Bag 92019, Auckland 1142, New Zealand.

Telephone +64 9 373-7599 ext. 83711.

Email: [humanethics@auckland.ac.nz](mailto:humanethics@auckland.ac.nz)