# Use of alternative light sources in the search and recovery of human remains after a fire

Investigating the extent to which alternate light source techniques can improve the rates of bone recovery at fires scenes.

## Key details

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| **Lead institution** | University of Portsmouth |
| **Principal researcher(s)** | Emma Morgan<br>emma.morgan1@thamesvalley.police.uk |
| **Police region** | South East |
| **Collaboration and partnership** | • CopperTree Forensics<br>• Attestor Forensics<br>• Scenesafe<br>• Forenteq |
| **Level of research** | PhD |
| **Project start date** | September 2019 |
| **Date due for completion** | October 2026 |

## Research context

This research aims to investigate the extent to which alternate light source (ALS) techniques can improve the rates of bone recovery at fires scenes by first understanding the mechanism of bone fluorescence.

This will be achieved by designing a series of experiments that will explore the:

- chemical changes in bone with increased temperature
- absorption of light with bone at a number of temperatures
- relative recovery rates for burned remains using different light sources

It is intended that the project will reach the following outcomes.

- Improve search and recovery rates of human remains at a fire scene.
- Minimised disturbance of a scene, which in turn decreases the risk of contamination to the search area.
- Potential to recreate scene.
- Improve current UK fire search and rescue protocols.
- Creation of a specific tool for the search of human remains after a fire (for example, specific light source or detection equipment).
- Application to further search and recovery scenarios – following a natural disaster for example.
- Compare how the two types of bone (animal and human) react to luminescence.

# Research methodology

Firstly, bones will be burnt in a controlled environment to assess their optimum luminescence. This will be done using a number of available ALSs.

Current light systems available to the researcher and to be used include:

- CopperTree Forensics – tnvestigation torches (LED and laser)
- Attestor Forensics – light cubes
- Sceneview, Scenesafe – Forenscope
- Lumateq – Superlite

Wavelengths from UV through to infrared will be studied with a variety of filters (where required). Images will be captured and scored based on fluorescence intensity and contrast. Further work will be done to quantify this data using ImageJ software to measure the red blue green composition of the image.

Unaltered remains will then be placed in a 'typical' bedroom/living room environment – to include furniture and personal effects of sorts, and set alight. Due to time and resources, the experiments may have to occur on a smaller scale to allow for replicates and parallel studies.

Among the replicates it is proposed to look at the effects of temperature, duration of fire and extinguishing method on the luminescent properties of bones. It is hypothesised that the chemicals in the various fire extinguishers may have a residual effect on the luminescence if they themselves have fluorescing characteristics, or could act as a barrier if not.

Another aim of this study is to assess whether time since burn affects the luminescence. Archaeological remains from a number of time periods will be studied under ALS to understand whether luminescence changes over time. If the bones do still fluoresce this would be useful when searching an archaeological site to know areas of importance. There is also the potential to aid in the search of missing victims when evidence of fire has long since gone.

Primarily pig bones will be used as the accepted medium for study in the UK. However, the researcher has access to cow, sheep and deer for comparative studies.

The researcher has a collaboration with the Amsterdam Medical Centre (AMC) to use human cadavers. There is a proposal to attend this centre to conduct this research on human samples. The ethical considerations to this arm of the research will be conducted to those standards set by the AMC.

Preliminary studies on porcine material has discovered that temperature has an effect on the fluorescence and supportive of the need to analytically research into the composition of bone at these various temperature.

The bone samples will be scrutinised by analytical techniques to include FTIR, XRD and spectrophotometry. This will aid in the understanding of the chemical changes in the bone at the different temperatures and assist in the understanding of the mechanism of fluorescence in such samples. This has the scope to leading the investigator to know which wavelength will give the best contrast when looking for thermally altered remains.

At this stage the sample size is unknown and ever developing. Some samples will be destroyed in the experimentation process. It is estimated that at least three samples will be created at each temperature point (100-1000°C).

Each uncontrolled burn will be run three times and use several different bone samples. Access to human material will be at the discretion of the AMC.