

Health & Safety Laboratory

An agency of the Health & Safety Executive



HEALTH & SAFETY  
LABORATORY

Using our brains to save and improve the lives of workers

# Buncefield Oil Storage Depot



## The Client

Health and Safety Executive  
Environment Agency  
Health Protection Agency

## The Problem

The Buncefield Oil Storage Depot was comprehensively damaged by a series of explosions and fires which started at approximately 6am on Sunday 11th December 2005. This was the largest event of its type in Europe since the 2nd World War. Several people were injured but none fatally. Many of the surrounding industrial premises were destroyed and windows were shattered at 1 km distance.

## What we did

HSL was called in immediately by the Health Protection Agency to collect air samples and perform analyses as soon as possible.

A scientist was “blue lighted” to the scene within a few hours of the request being received. Subsequently HSE asked HSL to carry out a wide-ranging investigation to establish the cause of the incident. The Environment Agency requested damage surveys and mapping of all the tank bunds.



The investigation covered the following principal areas:

- Examination and photography of site damage
- Interrogation of site CCTV images
- Investigation of control and alarm systems
- Fire and explosion studies
- Human factors issues: control room layout and shift working

The primary cause of the incident was found to be the overfilling of a tank containing unleaded petrol, resulting in the escape of 250,000 litres of fuel. There was little or no wind at the time and a vapour cloud, consisting of air and hydrocarbon vapour, was formed. This cloud spread around the site, following the natural topography, until it encountered a source, or sources, of ignition. The malfunction of the tank control and alarms systems was the key factor in explaining the release.

A series of experiments was carried out on the Buxton site using two full-scale models of sections of the storage tank in order to study the fuel release. The overpressure generated during the explosion was deduced from damage to buildings and cars; in the case of the latter, a number of vehicles were subjected to various explosive overpressures in a blast chamber at HSL in order to “calibrate” the damage observed in vehicles on the Buncefield site.

## Outcome/Benefits

HSL's findings were presented in a series of incident reports to HSE. Our staff will be required as expert witnesses in any legal proceedings. The magnitude of the overpressure generated during the explosion could not be explained by conventional wisdom relating to unconfined vapour cloud explosions. HSL is therefore collaborating with industry on a joint research project to study this phenomenon.