Cyprus University of Technology

Department of Civil Engineering and Geomatics

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Student Society of Civil and Geomatics Engineers

The **Department of Civil Engineering and Geomatics** and the Student **Society of Civil and Geomatics Engineers** would like to invite you to the guest lecture

FORENSIC ASSESSMENT OF EXPLOSION DAMAGE AT THE BUNCEFIELD OIL DEPOT

By **Dr Luke A. Louca**
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"Kyrenia Room", Andreas Themistokleous Building, Athinon Street, Limassol.

Abstract

Over the last few decades, there have been a number of major industrial accidents involving oil and gas installations worldwide. This includes the Buncefield event in the United Kingdom (UK) back in 2005 where a major oil spill resulted in the formation of a large vapour cloud which ignited, resulting in an explosion and the biggest fire in the UK since the second World War. Extensive damage subsequently occurred to both the plant and surrounding buildings due to much higher overpressures than would normally have been expected from a vapur cloud explosion of this nature. Surrounding buildings close to the site suffered severe structural damage. Light damage could even be found at a distance of up to 1.5 kilometres from the site. In response to this event, a great deal of work was carried out on collecting and analysing available evidence from the incident in order to understand the explosion mechanism and estimate the overpressure levels within the gas cloud that formed.

This included a number of damaged steel switch boxes which could be used as overpressure indicators on the site located within the area covered by the vapour cloud which suffered varying degrees of damage. A series of tests were commissioned after the event in order to compare the damage of the field boxes with controlled static and dynamic tests on similar boxes. The present work reports on numerical studies of the damaged steel boxes sunbjected to both detonation and deflagration scenarios and the assessment of the response of those boxes in order to aid the investigation of the explosion. The study has also been extended to the response of a portal frame structure outside the gas cloud which suffered varying degrees of damage in order to try and provide some guidance on the safe siting of industrial type structres from oil storage facilities.

Short Biographical Note

Dr Luke Louca is currently a Reader in the Department of Civil and Environmental Engineering at Imperial College London where he is engaged in teaching the design of steel structures and dynamics at both undergraduate and postgraduate level. His principal research interests lie in the behaviour of structures and materials subjected to impact and explosions. He has carried out a number of projects for both the oil and gas sector involving development of lightweight solutions to mitigate the effects of an explosion on offshore structures, developed guidance notes as part of an industry led consortium and carried out numerous assessments to assess the response of plated structures to typical hydrocarbon explosions. More recently, much of his work has focussed on the defence sector investigating the effects of more rapid detonation processes on both metallic and fibre composite structural systems. Studies have included developing connections in sandwich structures for improving survivability of ship bulkheads, development of constitutive models for modelling foams and damage models for fibre composite materials. The development of hybrid metal to composite connections and panels is also being studied experimentally and numerically. He has published some forty journal papers in this field and received sponsorship from a number of organisations including research council support (EPSRC), Dstl (Ministry of Defence), Office of Naval Research (ONR), Health and Safety Executive (HSE), UK Offshore Operators Association, Shell, BP and British Gas.

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