THE INSTITUTE OF PETROLEUM

QUANTIFIED RISK ASSESSMENT OF THE IGNITION OF FLAMMABLE VAPOUR ON PETROL FILLING STATION FORECOURTS DURING ROAD TANKER OFFLOADING DUE TO THERMITE SPARKING

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This report was prepared by J Gledhill, P W Griffin, R D Anderson, C R Hebden and D M Deaves of WS Atkins Consultants Ltd[1]. Alec O'Beirne (Kuwait Petroleum), Mike Lewis (Esso Petroleum Company) and Dave De Halle (Conoco) formed the Steering Group to provide input to the study and arrange site visits.

Draft versions of this report were sent to representatives of the following companies/organisations on the Institute of Petroleum's Road Tanker Panel, Service Station Panel and Distribution and Marketing Committee for review:

Association of UK Oil Independents (AUKOI)
Association of Forecourt Systems Contractors (AFSC)
Berry & Co
BP
ChevronTexaco Ltd.
Conoco Ltd.
Esso Petroleum Company Ltd.
Federation of Petroleum Suppliers (FPS)
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United Kingdom Petroleum Industry Association (UKPIA)
Van Ommeren Tank Terminals BV Ltd
Veeder-Root
Wincanton

John Hazeldean (Health and Safety Executive) and Roger Marris (West Yorkshire Fire and Civil Defence Authority) reviewed and agreed the IP recommendations contained in the Foreword.

[1] WS Atkins Consultants Ltd, Woodcote Grove, Ashley Road, Epsom, Surrey, UK, KT18 5BW. www.wsatkins.co.uk

FOREWORD

On 6th April 1999, a fire occurred at a filling station in West Yorkshire, UK, during a road tanker delivery of petrol. Vapour that had accumulated within a direct fill point chamber ignited, but was subsequently extinguished by the prompt action of the tanker driver to replace the fill point chamber lid. Whilst the vapour source was quickly identified the source of ignition was not so readily apparent. A fire investigation was conducted by the West Yorkshire Fire and Civil Defence Authority, the Health and Safety Executive and the Health and Safety Laboratory. It was concluded that the most probable source of ignition was incendive thermite sparks from either a light impact of one of the aluminium hose-end couplings with rusty steel, or the aluminium-smeared rusty steel hose end band striking a hard surface such as a kerbstone.

In June 2000 representatives from the Health and Safety Executive and the West Yorkshire Fire and Civil Defence Authority brought the IP's Road Tanker Panel's attention to the findings of the investigation. The IP's Distribution and Marketing Committee commissioned this report to quantify the risk of a thermite spark igniting petrol vapour during routine road tanker deliveries.

The risk of a particular driver being involved in a fire due to thermite sparking has been calculated to be around $2{,}2 \times 10^{-3}$/yr. However, there are considerable uncertainties in the calculations due to the paucity of ignition probability data for the low impact energies associated with dropping or dragging hoses. The sensitivity results in Section 6.3 indicate that this risk has possibly been overestimated by at least an order of magnitude. In addition, historical evidence gives an upper bound risk of 6×10^{-5}/yr which is a factor of around 35 lower than calculated. This again suggests that the results are very conservative.

The risk falls in the range within which the UK Health and Safety Executive considers efforts should be made to reduce the risk to As Low As Reasonably Practicable (ALARP). The IP's Road Tanker and Service Station Panels reviewed the recommendations of this report (see Section 7.2-7.3) to develop recommendations that, if implemented, would reduce the risk further. Subsequently the IP recommendations were reviewed and agreed by representatives of the UK Health and Safety Executive and West Yorkshire Fire and Civil Defence Authority. The industry-agreed re-commendations follow each of the recommendations taken from this commissioned report below. Their implementation is encouraged.

IP/HSE review of recommendations from Section 7.2 and 7.3

1) *The feasibility of designing a rubber (or other flexible material) tyre to fit around hose couplings (as discussed in Section 6.5) should be investigated.*

The IP has requested that UK-based hose end coupling manufacturers develop proposals for protection of the hose end for consideration; concerns over the durability and weight of potential solutions will have to be addressed. In addition the IP has requested that consideration be given to the use of a non-rusting material to replace the grade of steel that is usually used for the band that swages the hose on to the hose tail.

2) *In the case of petrol filling stations with manhole access to fill pipes in which there is a deep chamber, the IP/APEA guidance should be implemented to ensure that safety platforms are fitted to provide reasonable, safe access during delivery. This will minimise the likelihood of a driver slipping/falling and inadvertently dropping*