Guidance for the storage and handling of fuel grade ethanol mixtures at petroleum distribution installations

energy institute

GUIDANCE FOR THE STORAGE AND HANDLING OF FUEL GRADE ETHANOL MIXTURES AT PETROLEUM DISTRIBUTION INSTALLATIONS

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FOREWORD

This publication was originally produced by Alan Adams, and has been updated by James Coull at the request of the Energy Institute (EI) Distribution and Marketing Committee to complement EI *Model Code of Safe Practice Part 2: Design, construction and operation of petroleum distribution installations*. It is intended to provide information for those involved in the storage and handling of fuel grade ethanol mixtures at petroleum distribution installations.

This publication has been prepared specifically to address the handling of fuel grade ethanol mixtures in the UK, which includes a specific type of denaturant, not typically encountered outside of the UK.

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Suggested revisions are invited and should be submitted to the Technical Department, Energy Institute, 61 New Cavendish Street, London, W1G 7AR.

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1 INTRODUCTION AND SCOPE

1.1 INTRODUCTION

The *European Renewable Energy Directive* 2009/28/EC and the *European Fuel Quality Directive* 2009/30/EC promote the use of biofuels or other renewable fuels for inclusion in the diesel and petrol blends sold in Member States. The UK Government's response was *The Renewable Transport Fuel Obligations Order* (RTFO) which was first published in 2007 and has been subsequently amended on a number of occasions[1]. This places an obligation on fuel suppliers to ensure that a minimum target percentage of biofuel is contained in fuels used for road transport (petrol and diesel) and non-road mobile machinery. The target percentage required under the RTFO (2013 amendment) is that fuel overall contains at least 4,75 % by volume and this is an average across all the fuels and does not have to be the same in each individual fuel. The Department for Transport (DfT) plan a further revision to the RTFO in 2017 which is likely to increase the target.

To achieve these targets, biofuels may be made available in a number of forms, such as 100 % or high concentration biofuels, or as biofuels blended into mineral oil derivatives in accordance with the appropriate existing European norms. In the UK, the petrol standard is defined by BS EN228 which defines the maximum quantities of biofuels which can be blended. The standard currently allows for two grades; fuel with up to 2,7 % m/m oxygen, which typically contains up to 5 % volume ethanol and is therefore known as E5, this is the grade most commonly marketed today. A second grade allows fuel to contain up to 3,7 % m/m oxygen and this typically contains up to 10 % volume ethanol and is known as E10. E10 is not currently sold in the UK but may be introduced as we approach 2020. Higher ethanol blends, e.g. E20 or E85, are not currently anticipated to be introduced until after 2025. Methanol, ethanol and other oxygenates can also be blended either individually or together, but could displace each other since the fuel is limited by the maximum overall oxygen content.

Bioethanol (ethyl alcohol) is an alcohol made from renewable sources and has typically been produced by fermenting starchy or sugary solids from crops such as corn, wheat, sugar cane and beet, into bioethanol and water. For ethanol, methanol or their derivatives, such as MTBE or ETBE, to be allowed under the RTFO, the fuel has to be renewable and meet the carbon and sustainability criteria as defined within the *Renewable Energy Directive*.

If the renewable fuel is derived from a waste or residue feedstock then it will receive twice as many Renewable Transport Fuel Certificates (RTFCs) as those derived from other feedstocks. This means that it 'double counts' and therefore a renewable component derived from waste which is physically present at 1 % volume in a fuel blend counts as 2 % compliance within the RTFO.

The properties of ethanol and ethanol mixtures are such that the preferred practice for blending with petrol is for this to take place so that contamination with water is avoided. In practical terms this is usually either at rail supply locations or road distribution terminals, and therefore appropriate facilities and measures will need to be in place to manage the receipt, storage and handling, denaturing and blending of bioethanol mixtures.

[1] The RTFO has been amended in 2009, 2011, 2013 and 2015

1.2 SCOPE

The object of this guidance is to provide a technical overview and understanding of the issues associated with the storage and handling of fuel grade ethanol mixtures, the blending of ethanol mixtures into petrol and subsequent storage and handling of petrol/ethanol blends.

For the purposes of this document, an 'ethanol mixture' is defined as including various combinations of ethanol and methanol along with denaturants such as petrol or a trade specific denaturant for use in a road fuel. The term 'petrol/ethanol blend' refers to petrol combined with an ethanol mixture.

Petrol/ethanol blends are generally referred to as E5, E10, E20, E85 to represent blends with up to 5 %, 10 %, 20 % and 85 % volume ethanol respectively. Currently within the UK retail sales are E5, although it is expected that blends with higher proportions of ethanol mixtures such as E10 will be made more widely available in future years. It is likely that when E10 is widely sold within the UK, E5 blends will still be required for use within older cars (as at 2015, indicatively around 85 % of all cars used in the UK may use E10; however, before use consumers should check with their car manufacturers). It should also be noted that blends with a greater proportion of ethanol mixture than E5 will require labelling at the retail pumps. The requirement to label pumps is set out in The Biofuel (Labelling) Regulations 2004[2] and for any ethanol blend greater than 5 % volume requires that the words 'Not suitable for all vehicles: consult vehicle manufacturer before use' are displayed prominently on any dispenser from which such fuel is sold or offered for sale to the ultimate consumer.

This guidance concentrates on the specific issues relevant to the UK and considers the current situation with petrol/ethanol blends with up to 5 % ethanol, E5, and also highlights areas where different issues exist with the handling of higher blend ratios up to 20 % ethanol, E20. Blends with greater than 20 % ethanol are beyond the scope of this document.

1.3 PETROL/ETHANOL BLENDS VOLUME VERSUS ENERGY

Due to the lower energy content of ethanol, the total energy content of the final petrol/ethanol blend may be reduced slightly by approximately 1,5 % for E5, and 3 % for E10.

1.4 UK LEGAL FRAMEWORK

In line with the *European Renewable Energy Directive* 2009/28/EC and the *European Fuel Quality Directive* 2009/30/EC, the *UK Renewable Transport Fuel Obligations Order* 2007 (RTFO) was introduced and subsequently amended in 2009, 2011, 2013 and 2015. This places an obligation on fuel suppliers to ensure that a minimum target percentage of biofuel is contained in fuels used for road transport (petrol and diesel) and non-road mobile machinery. The target percentage required under the RTFO (2013 amendment) is that the fuel contains at least 4,75 % volume which is an average across all the fuels and does not have to be the same for each individual fuel.

Bioethanol blended as E5 petrol is currently the main biofuel used to meet the RTFO target and it is anticipated that E10 may be introduced into the market as we approach 2020.

[2] There is also a new European standard in development on fuel labelling BS EN 16942.