EI literature review

Biofuels - potential risks to UK water resources

EI LITERATURE REVIEW: BIOFUELS – POTENTIAL RISKS TO UK WATER RESOURCES

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FOREWORD

It is widely recognised that the use of biofuels for road transport in the UK and throughout the world is increasing. Decisions concerning the use and management of new fuel components must be underpinned by a sound understanding of the potential risks. Experience in the US with the fuel component methyl tertiary-butyl ether (MTBE) has served to highlight that understanding risks to groundwater is of particular issue.

The project was commissioned with the aim of producing a review of available information on road transport fuels and to assess the potential impacts that the storage, transportation and use of biofuels could have on groundwater resources in the UK. It is intended that the information within this review could be used by decision makers in industry and government to make informed judgments on the potential risks to groundwater posed by certain biofuels.

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1 INTRODUCTION

The use of biofuels for road transport in the UK and throughout the world is increasing. This increase in use is largely driven by policies to reduce carbon emissions and to decrease reliance on non-renewable fossil fuels. However, the manufacture, distribution and use of biofuels also present potential risks to the environment and it is important to understand such risks to ensure that any harmful effects are managed and minimised.

Understanding the risks to groundwater is of particular issue in light of experience in the US with the fuel component methyl tertiary-butyl ether (MTBE). The use of MTBE was encouraged to improve air quality, but subsequent concern over the potential impacts to groundwater has led to the use of this compound being banned in several states. Thus, it is important to understand the potential risks from any new fuel components to properly inform decisions concerning their use and management. This report describes the potential for risk that the distribution and use of biofuels could pose to groundwater resources in the UK.

1.1 BACKGROUND

The increase in use of biofuels for road transport is driven by many factors including concerns about greenhouse gas emissions, national energy security issues and increases in crude oil prices (NNFCC, 2006). In Europe, the most significant factor is undoubtedly the EU "Biofuels Directive" (Directive 2003/30/EC), introduced in May 2003. This called for Member States to set national indicative targets promoting the increased use of biofuels or other renewable fuels for transport. In response to the directive, the UK Department of Transport introduced the Renewable Transport Fuels Obligation (RTFO) in November 2005. This places a legal requirement on transport fuel suppliers to ensure that a specified percentage of their overall fuel sales is from a renewable source. The timeframe for achieving the specified percentages is as follows:

— 2,5% by volume in 2008-09 financial year
— 3,75% by volume in 2009-10 financial year
— 5% by volume in 2010-11 financial year

Road transport fuels consumption figures show that approximately 18 million tonnes of petrol and 21 million tonnes of diesel were used within the UK in 2007 (BERR, 2007). Thus, the RTFO is expected to result in a significant volume of biofuels being used within the UK. A variety of financial incentives are offered to encourage these targets to be met. These include duty reductions for biofuels, penalty taxation for non-compliance and tax reduction incentives for the construction of biofuel processing plants. The implementation of the RTFO should mean that the volume of biofuels used within Europe, including the UK, will increase significantly over the coming years. Indeed, figures from European Commission (2006) indicate that 1,7 million tonnes of biofuels were produced in the European Union in 2003, 26% more than 2002.

The legislative requirement for increased use of biofuels has lead to further debate on the environmental costs and benefits associated with their use. A recent report by the Royal Society (2008) dispels the myth that biofuels are carbon neutral and points to the range of potential impacts that must be considered when assessing the merits of different biofuels. The potential impacts to groundwater are just one of many potential impacts. Other potential impacts are not within the scope of this report but are summarised below to enable the potential groundwater impacts to be placed in context.

An important element of the debate is the greenhouse gas savings that arise from biofuels relative to fossil fuels. Clearly, any carbon released during biofuel combustion was originally absorbed from the atmosphere during growth. However, significant carbon emissions are also associated with the energy used for the growth and manufacture of biofuels and can also occur from soils as a result of the clearance of land for growing biofuel crops. The carbon emission performance of biofuels is largely related to the efficiency of their production relative to that of fossil fuels.

In general, studies assessing the carbon emissions from the overall lifecycle of biofuels conclude that they result in lower carbon emissions than fossil fuels. For example, work conducted for DEFRA (Sheffield Hallam University, 2003) showed that biodiesel resulted in 71% less carbon emissions than fossil fuel diesel. A similar result was obtained by a study for the US Departments of Agriculture and Energy, which showed that biodiesel resulted in 75% less carbon emissions (NREL, 1998).

The reported carbon emissions savings from bioethanol are more variable and are largely dependent on the type of feedstock and production process and whether by-products can be utilised. A recent lifecycle assessment study conducted at Massachusetts Institute of Technology (Groode, 2006) states that bioethanol manufactured from corn creates as much carbon dioxide per unit energy produced as fossil fuel. However, bioethanol produced from more energy efficient crops, such as sugar beet and wheat, results in lower carbon emissions. A European study has shown that bioethanol produced from these crops results in 27% lower greenhouse gas emissions than fossil fuels (CONCAWE, 2002).

Another important concern in the biofuel debate is the potential impacts caused by increased demand for land for growing biofuel crops. The area of land required for the growth of crops used as a feedstock for biofuel production could be significant. For example, to meet the 5% biofuel target for the UK approximately two million tonnes of biofuel will be required each year. Assuming an approximate yield of one tonne of biofuel per hectare per year, an area of agricultural land of the order of two million hectares would be required to fulfil the UK's biofuel demand. This area equates to approximately one third of all arable land within the UK. The increased demand for agricultural land could result in an increase in food prices and lead to other impacts such as a reduction in biodiversity (e.g. replacement of South American rainforest with sugar cane plantations [ENDS, 2007a]) and deterioration in groundwater quality caused by an increased use of fertilisers.

Possible increases in smog and associated health effects caused by the combustion of biofuels have also been predicted (ENDS, 2007b).