

Road Transport Emissions from Biofuel Consumption

Tim Murrells & Yvonne Li

UK Emissions Inventory Stakeholder Meeting

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Emissions from Biofuel Consumption

- Study focused on data needs and treatment of biofuels in inventory reporting. Estimating emissions of:
 - AQ pollutants
 - Non-CO₂ GHGs
 - Air toxics
- Study ***DID NOT*** consider:
 - CO₂
 - Fuel cycle, life cycle emissions
 - Sustainability issues

More Details

 **AEA Energy & Environment**
From the AEA group



Road Transport Emissions from Biofuel Consumption in the UK

AEAT/ENV/R/2662

Report to The Department for Environment, Food and Rural Affairs,
Welsh Assembly Government, the Scottish Executive and the
Department of the Environment for Northern Ireland

ED05450007
Issue 1
July 2006

National
Atmospheric
Emissions
Inventory

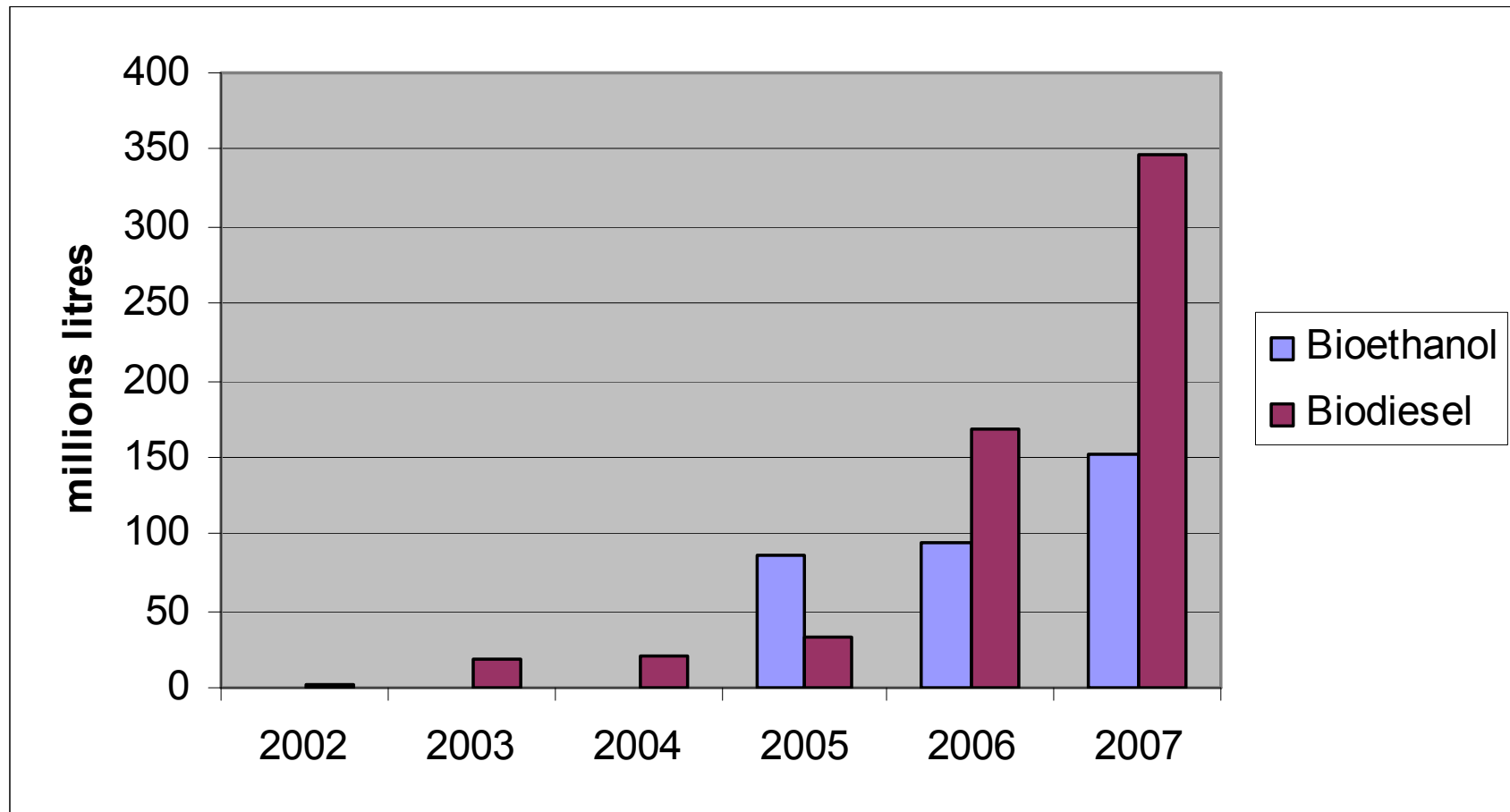


Scope of study

- UK biofuel consumption data
- Vehicle emission factors for different *first-generation* biofuels
 - Bioethanol
 - Biodiesel
 - Biogas
- *Second-generation* biofuels not investigated
- Model UK road transport emission projections for different biofuel uptake scenarios

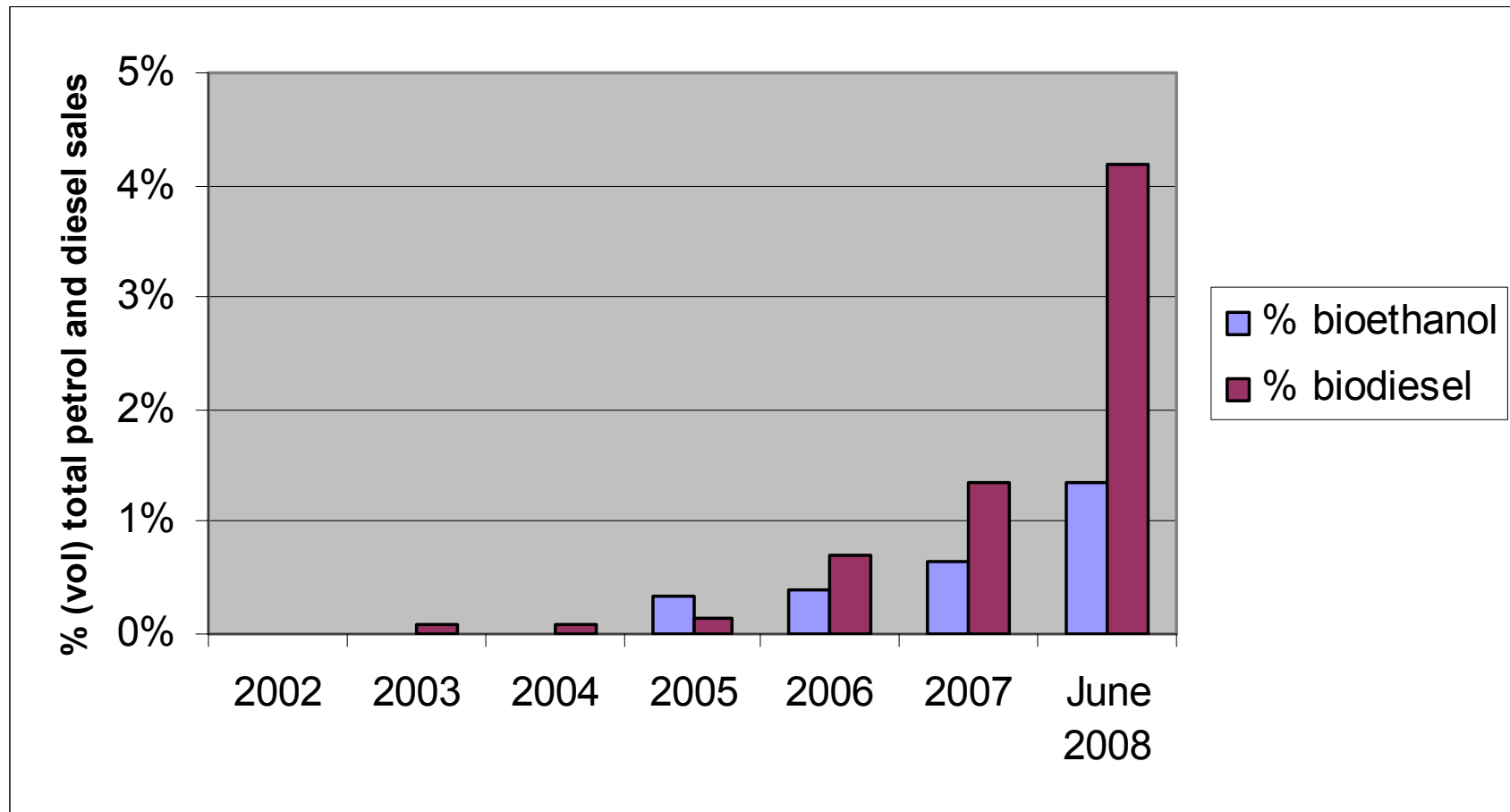
Consumption of biofuels in the UK

Data from HM Revenue & Customs: Hydrocarbon Oils Bulletin



Consumption of biofuels in the UK

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Biofuel consumption data

- HMRC are the only providers of national statistics on biofuel consumption
- No information on:
 - Type of biofuels consumed
 - Feedstocks
 - Mixture strengths
- Vehicle emissions of many pollutants depend on types of biofuels consumed and mixture strength – not always a linear relationship

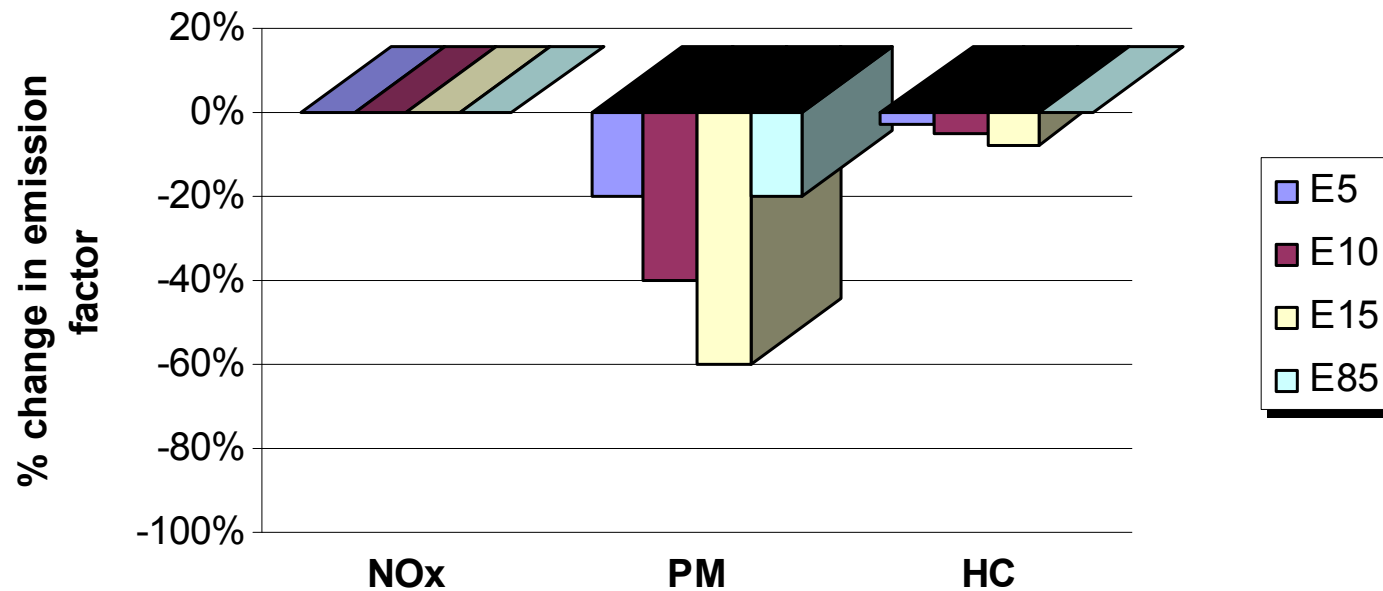
Review of biofuel emission factors

- Literature sources – mainly European and North American
- For low strength blends, effects on emissions are small for many pollutants
- Some studies give varied and conflicting trends, even in directional change in emissions
- Reflects variability in emissions with
 - Vehicle age and condition
 - Engine management systems
 - Aftertreatment systems
 - Duty cycle
 - Composition of base fuel – defining the reference point
 - Re-tuning necessary for high or pure blends

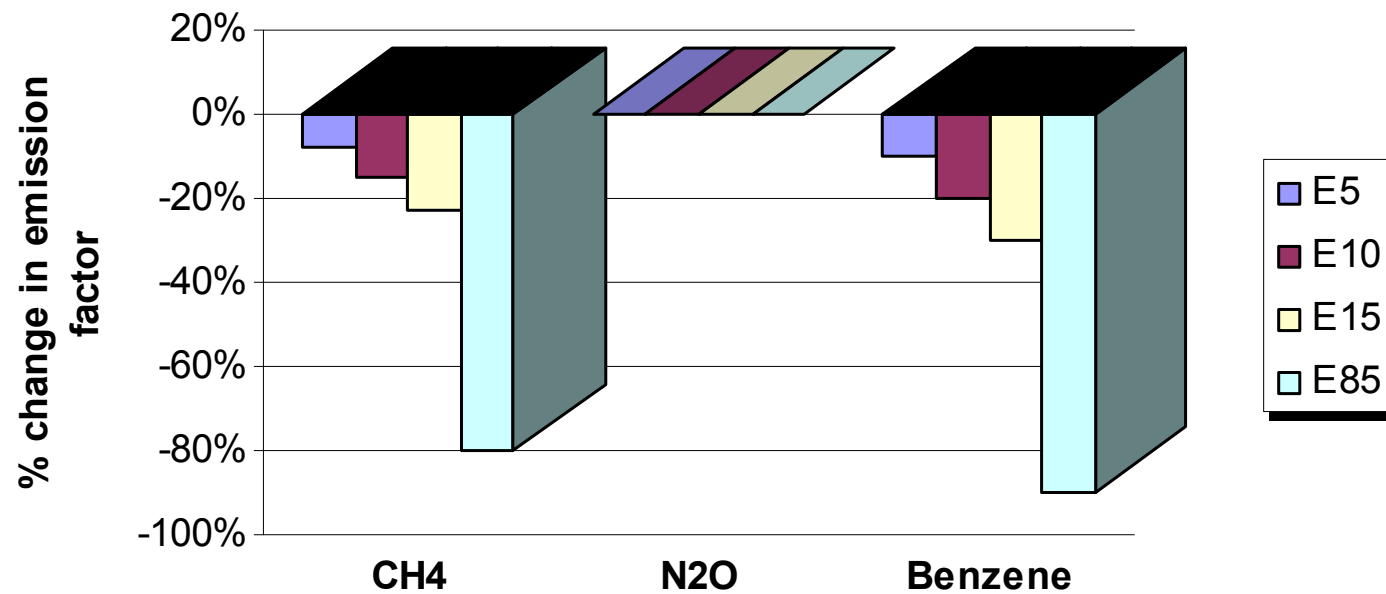
Types of biofuels reviewed

- Bioethanol: E5-E85
- Biodiesel
 - Transesterified oils (e.g. RME)
 - Virgin plant oil
- Biogas
- Effects on:
 - Regulated pollutants: NO_x, PM, HC, CO
 - Non-CO₂ GHGs: CH₄ and N₂O
 - Air toxics
 - Evaporative emissions

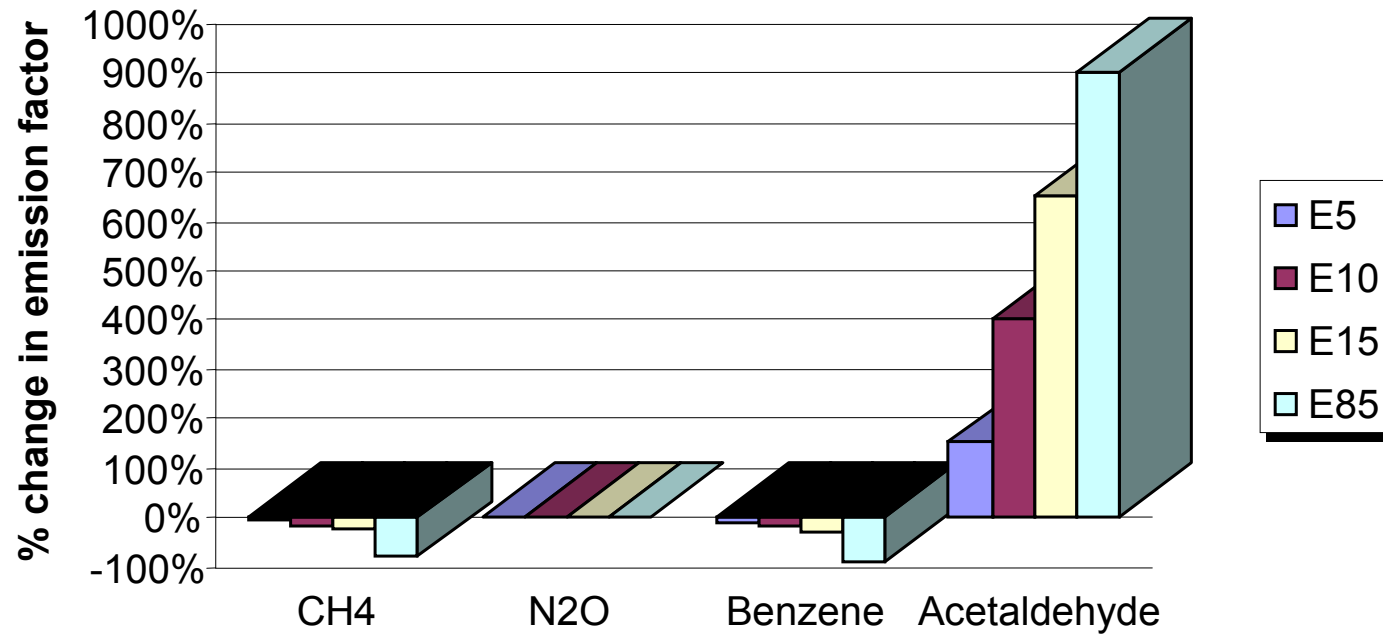
Effect on emission factors: bioethanol



Effect on emission factors: bioethanol



Effect on emission factors: bioethanol



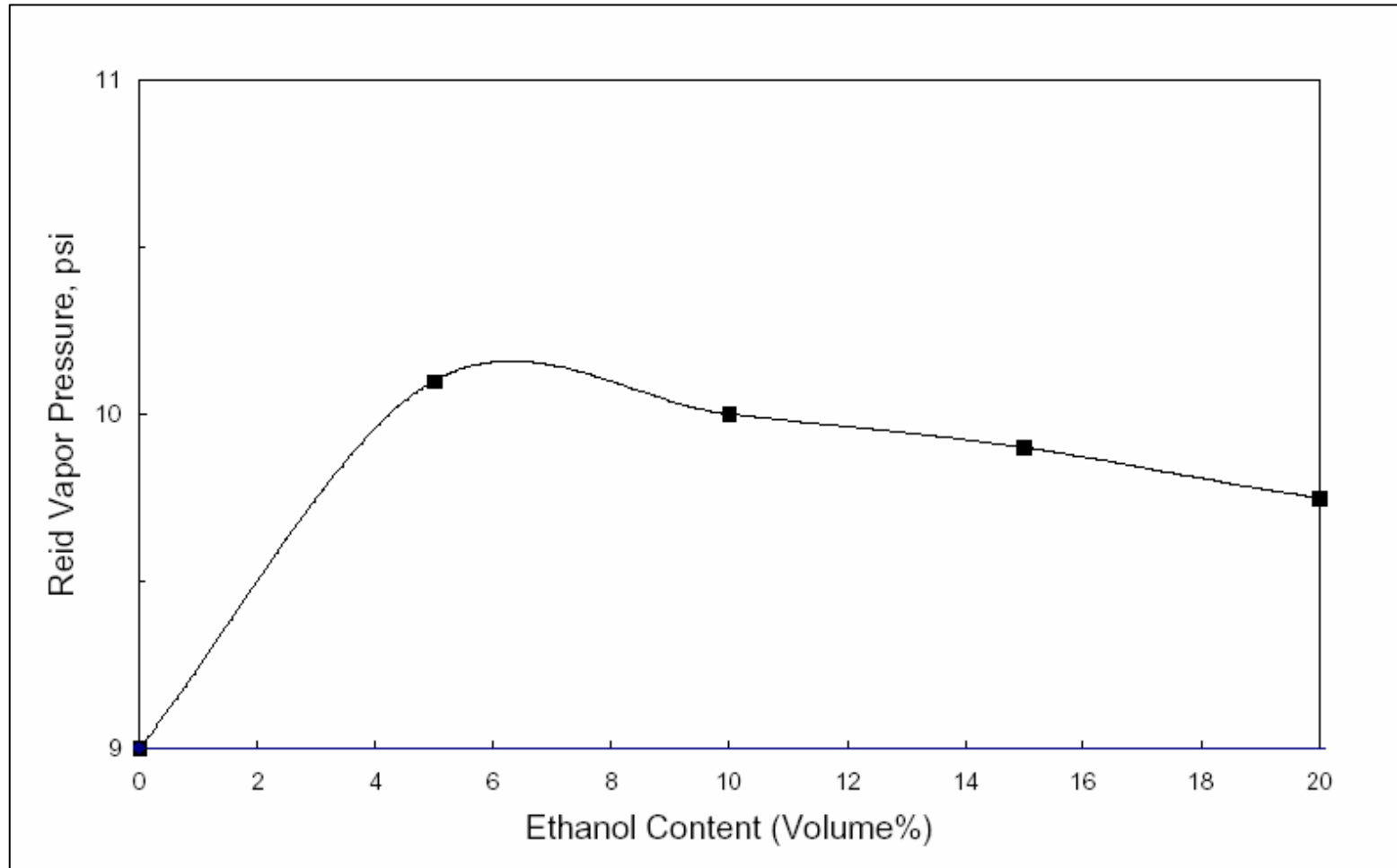
Acetaldehyde

- A toxic air pollutant as defined by U.S. Clean Air Act
- Traffic responsible for approx. 25% of primary acetaldehyde emissions in UK
- Precursor to ozone and photochemical air pollution
- But, is a major intermediate in the atmospheric oxidation of many other VOCs

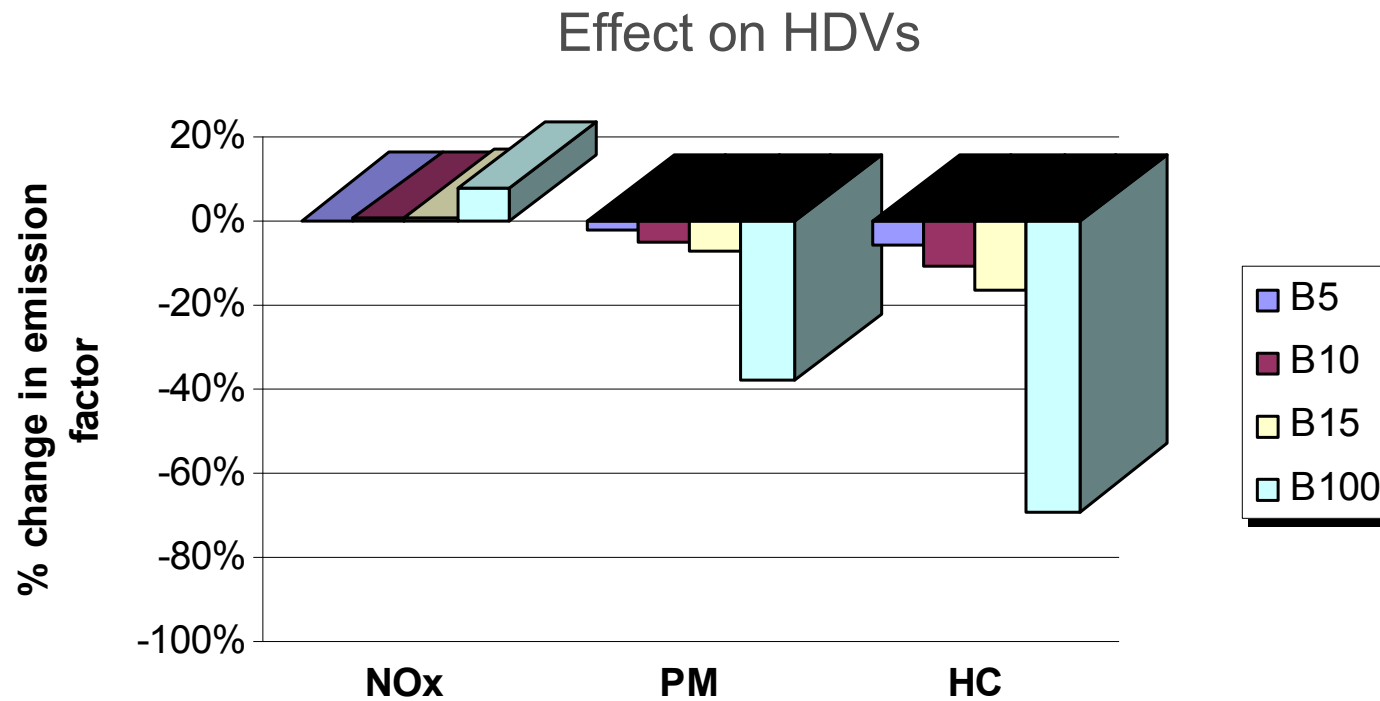
Evaporative emissions

- Adding small amounts of ethanol (up to 10% v/v) increases vapour pressure of fuel.
- Increases evaporative emissions of NMVOCs
- Lower volatility at high strength ethanol blends

Change in Volatility of Petrol on Blending with Ethanol

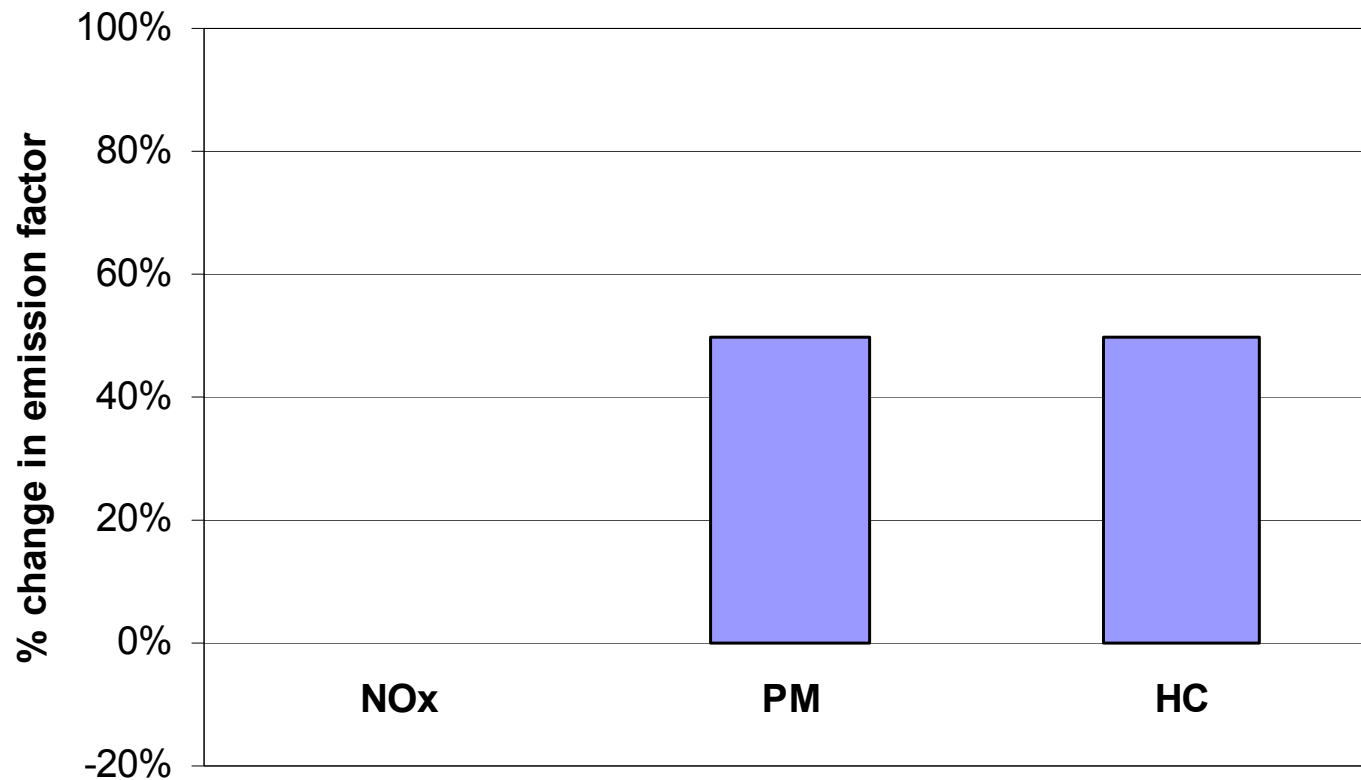


Effect on emission factors: biodiesel rapeseed methyl ester (RME)



Effect on emission factors: biodiesel virgin plant oil

- Few studies and results not consistent
- Usually requires conversions and engine re-calibrations



Effect on emission factors: biodiesel

	All toxics	Benzene	1,3-butadiene	PAHs	CH ₄	N ₂ O
RME	√	X	O	√	O	O
VPO	-	X	X	O	O	O

√ indicates a likely decrease in emissions relative to petroleum-based fuel (i.e. a beneficial effect)

O indicates weak effect or no clear trend, with equal evidence for increase and decrease in emissions relative to petroleum-based fuel (i.e. no clear effect)

X indicates a likely increase in emissions relative to petroleum-based fuel (i.e. negative effect)

