THE INSTITUTE OF PETROLEUM

Speciation of VOC Emissions from UK Oil Refineries: Part 2 - Literature Survey

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February 2002

Published by
The Institute of Petroleum, London
A charitable company limited by guarantee

ISBN 0 85293 346 0

Published by The Institute of Petroleum

Further copies can be obtained from Portland Press Ltd. Commerce Way,
Whitehall Industrial Estate, Colchester CO2 8HP, UK. Tel:+ 44 (0) 1206 796 351
email: sales@portlandpress.com

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ACKNOWLEDGEMENTS

This literature survey was undertaken on behalf of the Institute of Petroleum by Howard Rudd of AEA Technology plc under the guidance of the IP's Emissions Working Group and in cooperation with UKPIA's Refinery Working Group (WG15).

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INTRODUCTION

At the end of 1999 the Institute of Petroleum was asked by UKPIA, on behalf of the refineries based in the UK, to provide a means through which emissions of Volatile Organic Compounds, reported annually as part of the Environment Agency's Pollution Inventory, could be speciated. In 2000 the Institute commissioned AEA Technology, under the guidance of the IP's Emissions Working Group, to investigate the possibility of producing a generic protocol to enable refineries to speciate VOCs. This was to be used in conjunction with the IP's existing Protocol for the Estimation of VOC Emissions from Petroleum Refineries and Gasoline Marketing Operations.

This is Part 2 in a series of three reports. It details the outcome of a literature review undertaken at the front end of this project. Part 1 presents an broad overview of the work carried out and acts as a summary for the whole project. Part 3 describes the detailed results of the measurements carried out at nine UK refineries.

BACKGROUND

VOCs can be defined as all organic compounds originating from anthropogenic activity , but excluding methane, that are capable of forming photochemical oxidants by reactions with nitrogen oxides in the presence of sunlight. They are the subject of numerous legislative initiatives impacting on the UK petrochemical sector. These include the EU Solvents Directive, which came into force in March 1999 and sets limits on the emission of VOC based solvents at the point of consumption; also the UNECE Gothenburg Protocol and EU National Emissions Ceilings Directive (NECD), both of which set national limits for VOC emissions.

VOCs are therefore reported annually to the Environment Agency as part of the National Pollution Inventory, usually as total mass - the sum of the masses of all the individual compounds present. Emissions of total VOCs across the UK are falling sharply as historic legislative moves begin to take effect, even before the impact of the above legislation is taken into account. Against this improving backdrop, attention is increasingly turning to the impact of individual species of VOCs. The purpose of this project is to devise a methodology for estimating the chemical composition of VOC emissions from refineries. A "species profile" is a list of the compounds present in the emission and their mass fractions, and "speciation" of an emission to determine its species profile is a complex task relative to simply estimating total emissions.

The composition of the emission depends on the type and relative proportions of the products from which the emission originates. These include crude oil and a large number of products derived from it such as gasoline, kerosene and naphtha. In a refinery in which no cracking or reforming takes place it would be reasonable to expect that the composition of the emission is approximately that of the vapour of the crude oil being processed, as the products are separated out of the crude oil with no chemical modification. However, cracking and reforming can significantly change the chemical composition of the products and subsequently any emissions.