Deriving Background Concentrations of NOx and NO_2 for Use with 'CURED V3A'

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1 Introduction

1.1 This note provides an update to the suggested approach[1] to treating background concentrations of nitrogen dioxide (NO_2) and nitrogen oxides (NOx) when using the Calculator Using Realistic Emissions for Diesels (CURED) model. Specifically, it provides revised uplift factors for use with version 3A of the model (CURED V3A).

1.2 In September 2016 a report was issued entitled "Deriving Background Concentrations of NOx and NO_2 for Use with CURED V2A"[1]. This provided two tables of scaling factors, along with a methodology explaining how these factors should be used. One table of factors (Table 1 in the 2016 report) scaled up the traffic-NOx component of mapped background concentrations to reflect the difference between EFT V7.0 and CURED V2A. The second table of factors (Table 2 in the 2016 report) provided a calibration between mapped background concentrations for 2014 and 2015 and concurrent measured background concentrations at national network monitoring sites.

1.3 A subsequent note was issued in May 2017[2]. This provided additional calibration factors based on 2016 monitoring data, which effectively appended to Table 2 of the 2016 report.

1.4 In December 2017 Defra issued EFT V8.0.1 and Air Quality Consultants issued CURED V3A[3]. The factors in Table 1 of the 2016 report were specific to EFT V7.0 and CURED V2A. Updated factors are thus required for use with CURED V3A. The background-uplift factors for use with CURED V3A are set out in Table 1 below. These effectively replace the values in Table 1 of the 2016 report. They should be applied using the methodology as set out in the 2016 report[1].

1.5 2017 calibration factors (to append to Table 2 of the 2016 report) will be published in due course.

1 http://www.aqconsultants.co.uk/getattachment/Resources/Download-Reports/Adjusting-Background-NO2-Maps-for-CURED-September-2016.pdf.aspx

2 http://www.aqconsultants.co.uk/AQC/media/Reports/2016-Background-Map-Calibration.pdf

3 http://www.aqconsultants.co.uk/AQC/media/Reports/Development-of-CURED-V3A-110117.pdf

Table 1: Typical Additional Emissions from CURED V3A Compared with EFT V8.0.1

Year	% Additional Emissions Expressed as a Fraction [a]
2015	0
2016	0
2017	0
2018	0
2019	0
2020	0.024
2021	0.067
2022	0.117
2023	0.165
2024	0.215
2025	0.267
2026	0.321
2027	0.380
2028	0.441
2029	0.501
2030	0.561

[a] for example 0.561 means that CURED V3A predicts, on average, 56.7% higher NOx emissions than EFT V8.0.1.

2 Derivation of Factors

2.1 The approach has followed that set out in the 2016 report[1], with the only differences being the use of more recent published traffic data, EFT V8.0.1, and CURED V3A. The approach is summarised below.

2.2 The Department for Transport publishes data for all its traffic counters across the UK each year[4]. These are the traffic data used by Defra to produce its background maps. The most recent published data are for 2016[5]. 2-way flows reported for 2016 for the 20,000 major and minor link sections with more than 1,000 vehicles per day[6] have been input to EFT V8.0.1. Each road has been entered into the EFT several times to cover all years (from 2015 until 2030[7]) and a range of road types[8,9]. The average assumed speed was 50 kph on each link. The same procedure was then carried out using CURED V3A. The two sets of results were then compared to see how the calculated emissions differ.

2.3 Figure 1 shows the results. The whiskers show the range for each year (i.e. the minima and maxima). The spread between the maxima and minima is smaller than was the case for CURED V2A[10], reflecting the different formulation of CURED V3A. There is no difference between CURED V3A and EFT V8.0.1 for years prior to 2020.

2.4 Despite the relatively large range shown by the whiskers in Figure 1, the quartile ranges are very narrow, showing that the majority of roads had relatively uniform fleet compositions and thus uniform divergence in emissions when comparing CURED V3A with EFT V8.0.1.

2.5 Figure 2 shows the mean values from Figure 1. These are the numbers used in Table 1.

4 Many of the year-specific flows are projections from counts made in other years.

5 https://data.gov.uk/dataset/gb-road-traffic-counts

6 as an Annual Average Daily 2-way Flow

7 i.e. the 2016 flows were assumed each year. Not factoring in traffic growth will have only a minor effect on this analysis since the key traffic feature of interest is the vehicle fleet composition.

8 The road types used in the EFT were: Inner London; urban in England outside London, rural in England outside London, and rural in Scotland.

9 All roads were assumed to represent all geographical locations, regardless of the actual location of the traffic count point.

10 Compare Figure 1 and Figure 2 with the equivalent figures from the 2016 report.

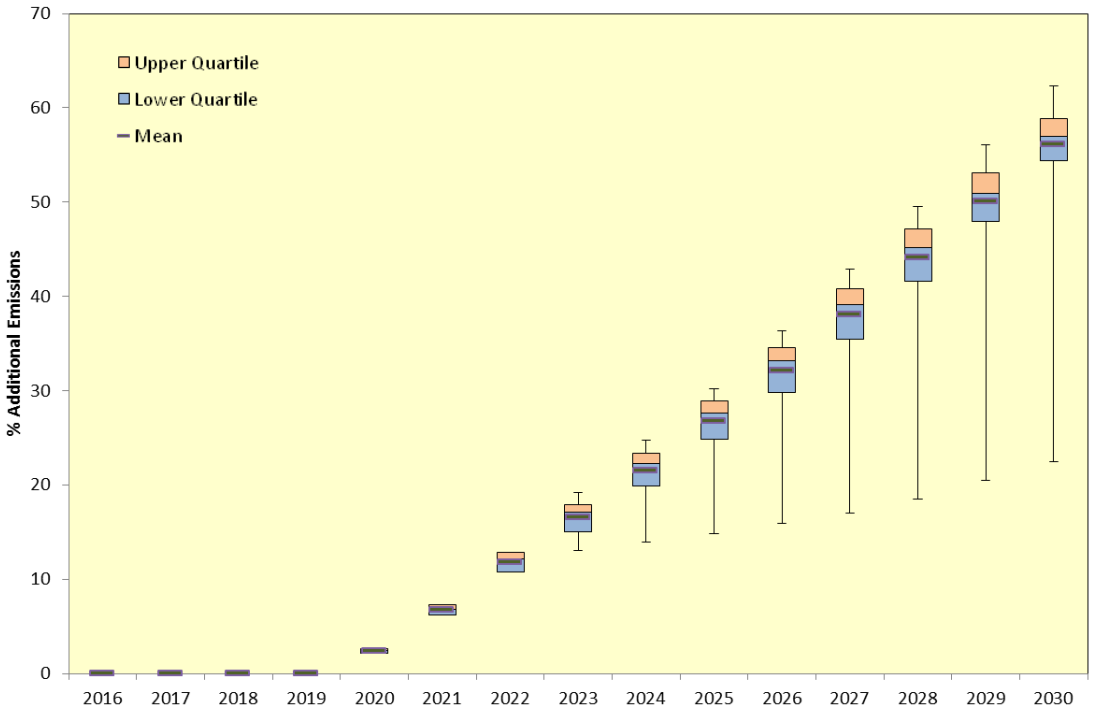

Figure 1: Additional NOx Emissions using CURED V3A Compared with EFT V8.0.1

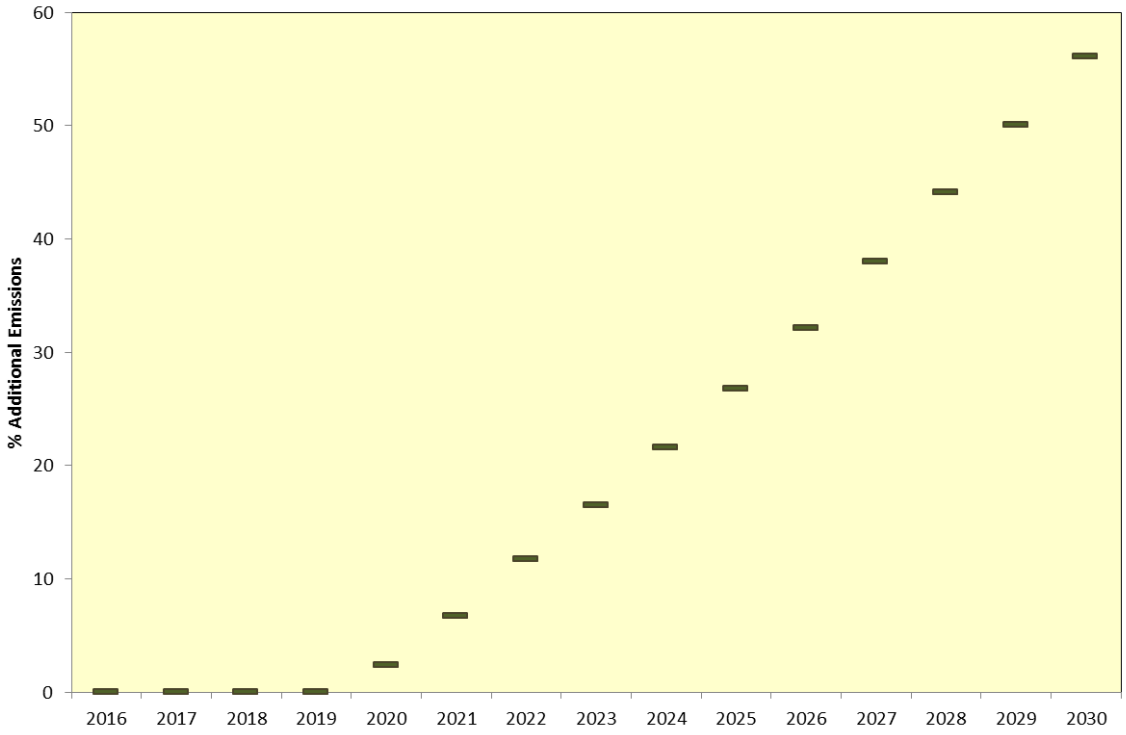

Figure 2: Mean Additional NOx Emissions using CURED V3A Compared with EFT V8.0.1