Relationship between CURED V2A and COPERT V5.0

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1 Introduction

1.1 AQC published Version 2A of its Calculator Using Realistic Emissions for Diesels (CURED) emissions model in August 2016. CURED V2A takes the emissions functions from the COPERT V4.11.0 model[1] and applies uplifts based on the results from real-wold emissions tests[2].

1.2 The UK Government's 2015 Air Quality Plan[3], and Version 7 Defra's latest Emissions Factors Toolkit (EFT)[4] are also based on version 4.11.0 of COPERT, but they do not apply any uplift factors. Since the publication of the 2015 Plan (and EFT V7.0 and CURED V2A), COPERT V5.0[5] has been published. COPERT V5.0 contains revised emissions functions; in particular having significantly altered NOx and NO_2 emission functions for the latest (Euro 6) passenger cars and light goods vehicles. An important feature of the COPERT V5.0 emission factors for Euro 6 diesel cars is the introduction of different functions for three time periods: 2015 to 2017, 2017 to 2020 and post-2020 vehicles; which align with the phased introduction of Real Driving Emissions (RDE) tests for vehicle type-approval. CURED V2A does not provide separate factors for these three different stages of Euro 6 diesel cars and light goods vehicles.

1.3 Defra is updating its national modelling using the COPERT V5.0 emissions functions as part of its new Air Quality Plan. It has also produced a revised version of the EFT; although this has not yet been made widely available.

1.4 Many users of CURED have thus asked whether CURED V2A continues to provide a robust assessment even though it pre-dates COPERT V5.0. This note provides preliminary answers to this question.

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[1] Computer Programme to calculate Emissions from Road Transport, developed through the European Environment Agency (EEA). http://emisia.com/products/copert

[2] http://www.aqconsultants.co.uk/getattachment/Resources/Download-Reports/Emissions-of-Nitrogen-Oxides-from-Modern-Diesel-Vehicles-210116.pdf.aspx

[3] https://www.gov.uk/government/collections/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2015

[4] http://laqm.defra.gov.uk/review-and-assessment/tools/emissions-factors-toolkit.html

[5] COPERT 4.11.4 was published at the same time as COPERT 5.0. This uses the same emissions factors as COPERT 5.0 but sets them out in an alternative format. It is not considered further in this analysis.

2 High-level Comparison of CURED V2A and COPERT V5.0

Differences in Speed-emissions Curves

2.1 AQC has compared the individual speed-emissions functions in COPERT V5.0 with those in CURED V2A, and some of the results are shown in Figure 1. Overall, COPERT V5.0 tends to predict higher emissions for Euro 6 vehicles than CURED V2A for diesel cars registered prior to 2017[6]. For all diesel vehicles registered from 2017 onward, CURED predictions are either about the same, or higher than those of COPERT V5.0. This is because CURED does not make any predictions about how effective RDE will be in reducing emissions, and assumes no improvements in the future compared with vehicles that have already been tested. COPERT V5.0, on the other hand, assumes that vehicles which do not yet exist, will emit lower levels of NOx than those vehicles which have been tested. There are good reasons to expect that this will be the case, but the scale of improvement is unknown.
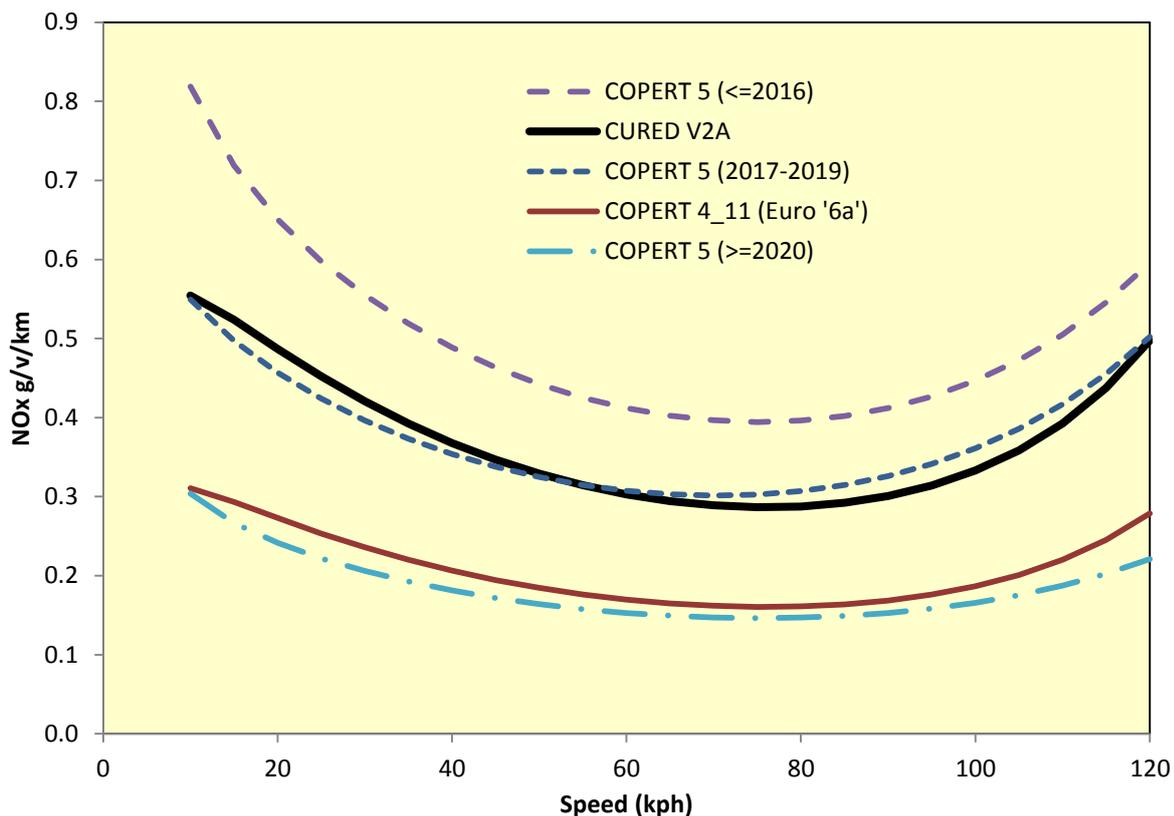

Figure 1: NOx Speed-emission Curves for Euro 6 Diesel Cars from Three Emissions Models

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6 It is noted that CURED V2A is based on emissions tests from a much larger sample of vehicles than COPERT V5.0 and this is likely to explain the difference (i.e. CURED is considered to be more realistic).

Effect of Vehicle Fleet Composition

2.2   CURED V2A uses fleet composition information that is published by Defra and also used in EFT V7.0. In order to apply the COPERT V5.0 functions, assumptions are required about the phased population of the fleet by different types of vehicles. In order to carry out high-level testing of COPERT V5.0, AQC has generated its own vehicle fleet projections, but it is recognised that these are unlikely to accurately reflect the (currently unpublished) assumptions made by Defra. For this reason, it is only currently possible to provide indicative comparisons of how CURED V2A will compare with Defra's new EFT based on COPERT V5.0 (as the new EFT, while being used by Defra, is yet to be published).

Effect of Model Verification

2.3   All modelling of road traffic emissions should compare predicted NOx concentrations from local roads against local measurements and adjust the model results if necessary. If models are calibrated in this way against base-year concentrations, the base-year concentrations become known with some degree of certainty. Thus, absolute emissions become less important than the *rate of change* in predicted emissions from one year to another.

Overall Comparison

2.4   The rate of change in NOx emissions predicted using different models is shown in Figure 2. This compares NOx emissions from a nominal road[7] (31,000 AADT, 5% HDV, 36kph, outer London),predicted using CURED V2A, AQC's COPERT V5.0-based model, and EFT V7.0. It shows that CURED and AQC's COPERTV5.0-based model predict almost the same rate of emissions reduction between 2016 and 2019, after which COPERT V5.0 predicts large reductions; ending up lower than EFT V7.0 in 2030. Comparisons for different roads and speeds show only marginally different patterns. Using alternative national fleet assumptions could, however, change these findings.

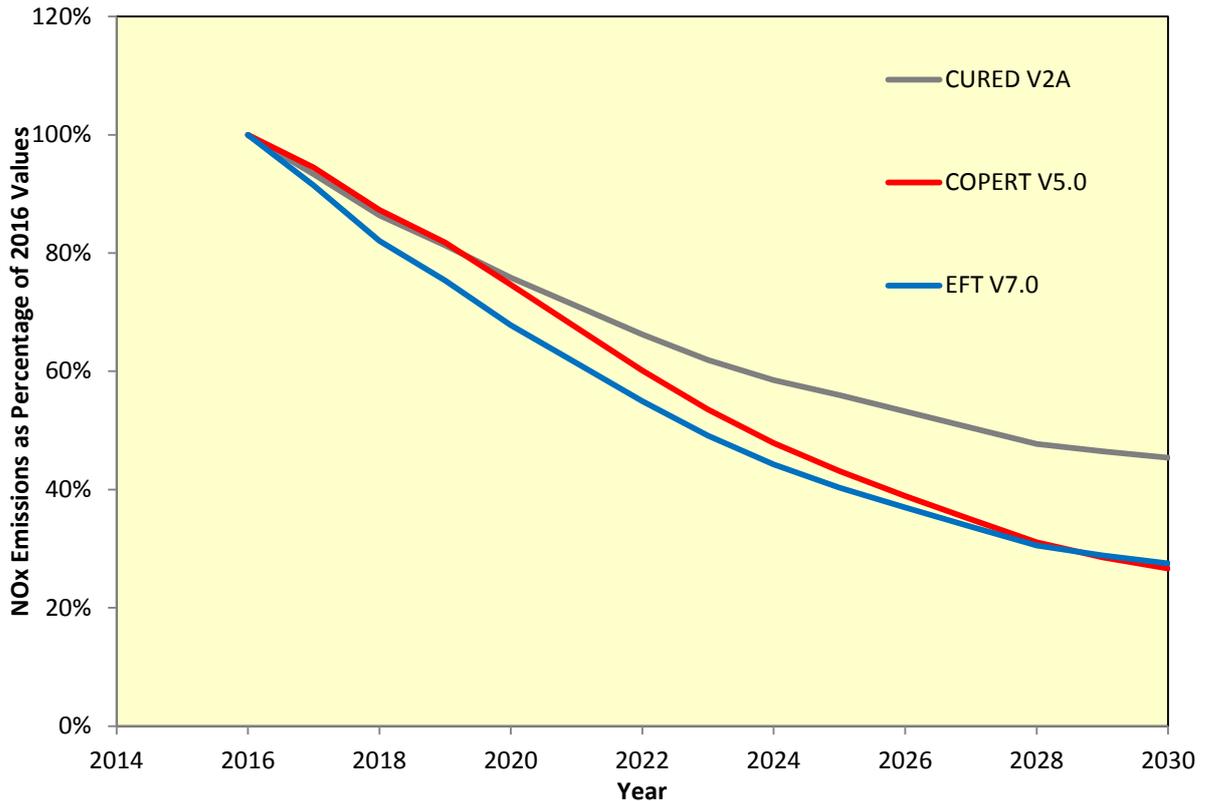[7] 31,000 AADT, 5% HDV, 36kph, Outer London.

Figure 2: **Relative Change in NOx Emissions Over 16 Years Assuming Constant Traffic Flows on a Nominal Road**

3   Conclusions

3.1   The exact way in which Defra has implemented COPERT V5.0 in its new EFT, including any changes that it has made to vehicle fleet composition, will be very important in determining how predictions using CURED V2A compare with those made using Defra's tools. Since Defra has not yet published its assumptions, it is only possible to make broad-brush predictions regarding how its tools will compare with CURED. The following points do, however, seem likely:

- for assessment years up to 2020, CURED V2A is likely to provide similar predictions of total NOx to those of a COPERT V5.0-based model; and

- for assessment years after 2020, CURED V2A is likely to predict higher emissions than a COPERT V5.0-based model.

3.2   This position will be revisited once Defra releases its models and assumptions for wider use, but for the time being, CURED V2A is considered to continue to provide a relevant basis for a sensitivity test on future-year NOx emissions.