

United States Environmental Protection Agency
Office of Mobile Sources

August 27, 1997

MEMORANDUM

SUBJECT: Emission Inventories Used in the Nonroad Diesel Proposed Rule

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TO: Docket A-96-40

The purpose of this memo is to document the portions of the mobile source inventories related to the Trends Reports that are being used in the EPA Notice of Proposed Rulemaking (NPRM) for diesel nonroad engines. Some of these inventories are used in Figures 1 and 2 in the Preamble of the NPRM. In addition, Figures 5-10 and 5-11 of the Draft Regulatory Impact Analyses use these inventories. Extensive coordination with the Office of Air Quality Planning and Standards (OAQPS) and its contractor, E. H. Pechan and Associates, has taken place to assure consistency between the inventories being used in the NPRM and those to be used in the updated 1997 version of the October 1996 report entitled "National Air Pollutant Emission Trends, 1900-1995."

Highway NOx and PM Inventories

The highway NOx inventory numbers used in the EPA NPRM for current and future years is available from some work that E. H. Pechan and Associates performed for EPA's Office of Mobile Sources (OMS) in 1994 (Contract No. EPA 68-30035). In addition, the October 1995 EPA OAQPS report entitled "National Air Pollutant Emission Trends, 1900-1994" provides these numbers for some of the years; these numbers agree well with earlier work done specifically for EPA-OMS. All of these numbers are based on MOBILE5a modeling runs, but with slightly different assumptions. These numbers are also being updated for the 1997 Trends Report; the updated numbers using MOBILE 5b were not available in time for this analysis, but are now available as an initial draft. The initial draft NOx numbers for future years for the 1997 Trends Report are consistent with those numbers for 2000, and 2005, and only slightly lower for 2010. The numbers from the October 1995 Trends Report and the numbers the contractor, E. H. Pechan and Associates, provided for EPA-OMS under contract are given in the table below.

Highway NOx Inventories (short ktons)		
Year	OMS Work From Pechan	Trends Report #s*
1996	7,028	7,041
2000	6,529	6,531
2005	6,280	6,281
2010	6,494	6,495
2015	6,962	
2020	7,547	

* October 1995 Trends Report

The highway diesel exhaust particulate (PM-10) values for 1995 is from the newly developed draft numbers for the 1997 Trends Report which were provided to us by OAQPS and its contractor, E. H. Pechan and Associates. These numbers are consistent with those for 1995 in the October 1996 Trends Report. In addition, newly developed draft numbers of highway particulate for the 1997 Trends Report were also provided to us for the years 2000, 2005, and 2010. The PM-10 numbers are based on the PART5 model. The numbers are listed in the table below.

Highway Diesel PM-10 Inventories	
Year	PM-10 (short ktons)
1995	174.3
2000	123.7
2005	82.8
2010	68.8

Stationary Source NOx Inventories

The stationary source NOx numbers are from the same contract work done for EPA OMS by E. H. Pechan and Associates referenced above; these numbers agree closely with those in the

October 1995 Trends Report for available years (1996, 2000, 2005, and 2010). These numbers are shown below.

Stationary Source NOx Inventories (short ktons)		
Year	OMS Work from Pechan	Trends Report #s*
1996	11,736	11,699
2000	10,842	10,806
2005	11,294	11,257
2010	11,950	11,913
2015	12,176	
2020	12,209	

* October 1995 Trends Report

Nonroad Diesel NOx and PM Inventories

The diesel nonroad numbers used in the NPRM include all the engine categories covered by the NPRM. OAQPS plans to use these numbers in the 1997 Trends Report for these categories. These estimates are much larger than those in the October 1995 and October 1996 Trends Reports. The numbers in the previous Trends Reports are based primarily on the “Nonroad Engine and Vehicle Emission Study - Report” issued by EPA in November 1991 and a later report (“Methodology to Calculate Nonroad Emission Inventories at the County and Sub-County Level,” July 1992), which included a large number of very detailed associated spreadsheets. These reports give detailed inventories for each county in 33 non-attainment areas which are extrapolated to estimate nonroad emissions for counties in other non-attainment areas. A national nonroad inventory was then calculated as the sum of the nonroad emissions in each county.

Since then, new 1995 information from Power Systems Research (PSR) was used as input to develop a new nonroad model (“Nonroad Emission Inventory Methodology,” Draft Report, 1997) to better predict nonroad emissions; a copy of this draft report is attached. This model predicts nonroad emissions inventories as a function of engine equipment population, annual hours of use, horsepower, engine load factor, and average emissions.

This model includes more engine types (such as light commercial equipment like generator sets over 50 hp) which are not included in the earlier inventories. This model is able to predict emissions though only on a national level. (Emissions for counties in individual nonattainment areas are estimated by applying a ratio of the new national inventory to the old national inventory to the old emission inventory for a particular nonroad equipment type determined for that county.) Predicting emissions at the national level with the new model

results in much larger farm/agricultural emissions than from using data from the 33 largely urban nonattainment areas which generally do not have much farm acreage. This model accounts for the benefits of the Tier 1 nonroad standards which reduce NOx to 6.9 g/BHP-hr starting for certain horsepower engines in 1996 and starting for other horsepower categories between 1996 and 2000. The table below gives a summary of the new emission inventories for NOx.

There are two sets of numbers that are essentially identical. The first set is the numbers for the 1997 Trends Report. The second set is the specific numbers for the OMS proposed rulemaking. The two sets of runs used a slightly different growth rate for a few of the individual equipment types. It was necessary to do these two separate sets of modeling runs using the OMS model for several reasons. The numbers for the 1997 Trends Report had to include the equipment types arranged by the source category codes (SCC) which are used in the Trends Report to list nonroad emissions. These SCC categories are slightly different from the PSR category codes inherent to the OMS model and used in the NPRM. In addition, the OMS modeling runs examined the emission impact by horsepower category for both a baseline level and with the proposed standards which did not have to be done for the Trends Report. The OMS numbers include recreational diesel marine below 50 hp which are not included in the modeling runs done for the Trends Report. As shown in the table, the two sets of numbers are very similar.

Nonroad Diesel NOx Emission Inventories		
Year	NOx (short kt tons) 1997 Trends Report #s	NOx (short kt tons) model runs
1995	3,087	
1996	3,088	3,141
1999	2,939	
2000	2,878	2,920
2002	2,775	
2005	2,685	2,725
2007	2,668	
2008	2,669	
2010	2,694	2,738
2015		2,878
2020		3,069

The table below gives the nonroad diesel inventory numbers PM-10 for the modeling runs done for the 1997 Trends Report using the SCC classification and those done specifically for OMS for the NPRM. Again, the two sets of numbers are essentially identical.

Nonroad Diesel PM-10 Emission Inventories		
Year	PM-10 (short ktons) 1997 Trends Report #s	PM-10 (short ktons) OMS model runs
1995	438	444
1996	444	
1999	468	
2000	471	477
2002	484	
2005	505	513
2007	520	
2008	527	
2010	543	551

The attached spreadsheet provides greater detail on how different nonroad diesel engine categories contribute to these overall NOx and PM-10 emissions. Individual inventory numbers are given for the nonroad equipment types by overall source category code (which is 7 digits) as reported in the Trends Reports (both previous Trends Reports and the 1997 Trends Report). Also, each of these equipment types has a number of “sub-equipment” types each of which has a more detailed 10 digit source category code; it is the sum of these “sub-equipment” types which constitutes the emissions for the equipment types. The “sub-equipment” types are listed, but the emissions for them are not listed but are available.

Other Nonroad NOx Emissions

Other nonroad NOx emissions incorporates all nonroad mobile source categories not covered in the nonroad diesel NPRM, including locomotives, gasoline engines, aircraft, and marine diesels above 50 hp. These numbers are based on the same modeling done by contract for OMS in 1994 as referenced above. These numbers are listed in the table below and are documented in more detail in the attached memo entitled “Nonroad Diesel and Mobile Source NOx Projections” from Tad Wysor to the Record, November 19, 1996 .

Nonroad Engine Emissions	
Year	NOx (short ktons)
1995	1,427
2000	1,476
2005	1,550
2010	1,644
2015	1,732
2020	1,823

Other Nonroad Diesel PM Emissions

Other nonroad PM-10 emissions shown in the diesel PM-10 figures in the NPRM incorporate emissions from include those from locomotives (all of which have diesel engines) and diesel commercial marine vessels.

Input for the 1997 Trends Report for locomotives is based on the recently proposed emission standards for locomotives and locomotive engines (Federal Register, Vol 62, No. 28, 6366-6405, February 11, 1997). This proposed rulemaking provides a thorough update of the locomotive emission inventory showing that the 1995 emission inventory for PM-10 given in the October 1996 Trends Report (50,000 tons) which is now believed to have been too high. The updated figure is 26,900 tons. Furthermore, the proposed rulemaking states that these emissions are projected to remain relatively constant in future years. (Increased rail usage is expected to be associated with increasingly fuel efficient engines; the PM-10 emission factor is a function of fuel consumption so increasing fuel efficiency counterbalances the higher locomotive usage resulting in relatively stable PM-10 emissions with time.)

PM-10 emissions from diesel commercial marine vessels are given in both the October 1995 and October 1996 Trends Reports. The former report also includes general projections for future years for nonroad equipment. We have obtained the specific numbers for commercial diesel marine that OAQPS used for the projection years. The PM-10 emissions for 1995 are 17 short ktons increasing to 22 short ktons in 2010. The table below gives the exact numbers used in developing the Trends Reports.

Commercial Marine Diesel Emissions	
Year	PM-10 (short ktons)
1995	17.0
2000	18.9
2005	20.9
2010	22.1

Although there is an increase of about 10% in the sum of the locomotive and commercial marine diesel emissions from 1995 to 2010, this increase was not considered for purposes of the nonroad diesel NPRM. A constant value for locomotives plus commercial marine of 44 short ktons was used for the years 1995 through 2010.

Attachments

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Addendum: Please note that the new nonroad model (“Nonroad Emission Inventory Methodology,” Draft Report, 1997) referred to in the above memo is not the same model as the more comprehensive NONROAD national emission inventory model being developed by the OMS Assessment and Modeling Division for all nonroad mobile sources for beta release early in the 1998 calendar year.