SUMMARY OF DISCUSSIONS ON GENERATING BASEYEAR AND FUTURE YEAR EMISSION INVENTORIES FOR AIRCRAFT, COMMERCIAL MARINE VESSELS AND LOCOMOTIVES FOR IAQR

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This document describes the approaches taken for the Clean Air Interstate Rule (CAIR) development of inventories for on-ground aircraft/airport emissions, commercial marine vessels, and locomotives. The key raw data used in developing emission inventories is available in the Excel spreadsheet called CommercialMarine_Airports_Trains_Data.xls.

Approach for Projecting Aircraft emissions:

1) **Base-year Emissions for Aircraft (military aircraft, commercial aircraft, general aviation, air taxi, aircraft refueling):** OTAQ agreed that, with the exception of PM from commercial aircraft, the aircraft emission estimates in the OAQPS 2001 modeling platform (the 2001 NEI) utilize more up-to-date methods than the methods used to generate the 2001 national emissions in the analyses done for the Nonroad Rule (spreadsheet emailed by Penny Carey on 2/5/2004). Thus, it was decided that the 2001 NEI estimates be used as the base-year inventory for the IAQR. However, a modification would be required to add county-level PM10 and PM2.5 commercial aircraft estimates to the 2001 inventory (item 3 below) because they are currently zero in the OAQPS 2001 inventory. In addition, modifications in PM2.5 emissions are needed for all aircraft categories to recompute PM2.5 as 97% of PM10 (item 2 below).

2) **Base-year PM2.5 Emissions from Aircraft:** OTAQ indicated that PM2.5 from diesel engines has been found to be 97% of PM10 (memo to the docket from Bruce Cantrell, sent to OAQPS on 2/19/04). While aircraft are not characterized as having diesel engines, the fuel used is closer to diesel than to gasoline. Thus, OTAQ recommends that PM2.5 from aircraft (military aircraft, commercial aircraft, general aviation, air taxi) be computed as 97% of the PM10 from aircraft.

3) **Base-year PM Emissions for Commercial Aircraft (2275020000)**: For PM, the 2001 baseline inventory currently has zero emissions for commercial aircraft, whereas there is a national number provided for the Nonroad Rule Analysis (PM10=2535 tons/year across 48-states in 1996). The decision was made to replace the zero PM in the 2001 baseline with either updated PM emissions based on an updated emission factor (approach 1, to be done if time permits) or, with the value in the Nonroad Rule Analysis (approach 2).
Approach 1: If time permits, OAQPS will compute PM emissions using AP-42 PM emission factors and FAA LTO data. Laurel Driver is in the process of getting a cost/time estimate for this work. At the February 19 meeting, the participants expected there would not be enough time to implement Approach 1 for the IAQR. **Approach 2:**

This backup plan will be used if there is insufficient time for approach 1 (likely situation). In this approach, the 1996 national PM estimates from the Nonroad Rule Analysis for commerical aircraft (PM10=2535 tons/year across 48-states in 1996), will be grown to 2001 using national-level LTO growth from the FAA Terminal Area Forecast (TAF) system (described more in item 4). Once an OTAQ national (48-state) estimate is made, OAQPS will compute a ratio of 2001 OTAQ national PM to 2001 OAQPS national VOC. The 2001 OAQPS national VOC is computed by summing the 2001 OAQPS baseline inventory's VOC estimates for commercial aircraft across the lower 48 States. OAQPS will apply this ratio to county-level 2001 VOC from the OAQPS 2001 baseline inventory.

4) **Projection Method for aircraft**: We explored two data sources to use for projecting the OAQPS 2001 baseline emissions. First we examined itinerant operation (ITN) projections from the model provided by the Terminal Area Forecast System (http://www.apo.data.faa.gov/faatafall.HTM). We ran this model the latter part of February 2004. Although ITN data are available by airport, we chose to sum the data to a national level to compute national level projections. Development of national-level growth factors from this more detailed information was made due time constraints in developing and examining the sub-national trends, and also as a result at looking at some large scale year-to-year changes in individual airport ITN values. The TAF system provides ITN data for the following operations: military aircraft, general aviation, commercial aircraft and air taxis.

We also looked at the trends shown in the NOX stringency Options study ("Analysis of NOx Stringency Options, Final Draft Report, September 2003"). In February 2004, the Sixth Meeting of the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) considered six options for increasing the stringency of aircraft engine NOx emissions standards. The NOx stringency study is a preliminary evaluation of the potential impact in the U.S. of these options (focused on major U.S. commercial airlines). It is a single scenario founded on a set of assumptions believed to be reasonable. It does not attempt to analyze all possible alternatives or to be directly comparable to analyses by ICAO/CAEP study groups. Its value is found in trends and relative changes and not in the quantitative results.

OTAQ selected to use the TAF data for projecting aircraft emissions from commercial aviation, general aviation, military and air taxi, as the NOX stringency study was limited in scope in that applies only to NOX and only on the commercial fleet. Also, for commercial aircraft the NOX stringency analysis was primarily done to show relative changes in NOx emissions for stringency options. (The methods used in the stringency study will be reviewed for potential future incorporation into EPA's larger, integrated inventory – absolute values.) In addition, the stringency study uses data from an earlier TAF model run which is inconsistent with the recently run TAF model.

Figure 1 shows the TAF projection trends. In making this plot, we normalized the ITN to the 1996 ITN to show the trend from 1996 of each of the operations.

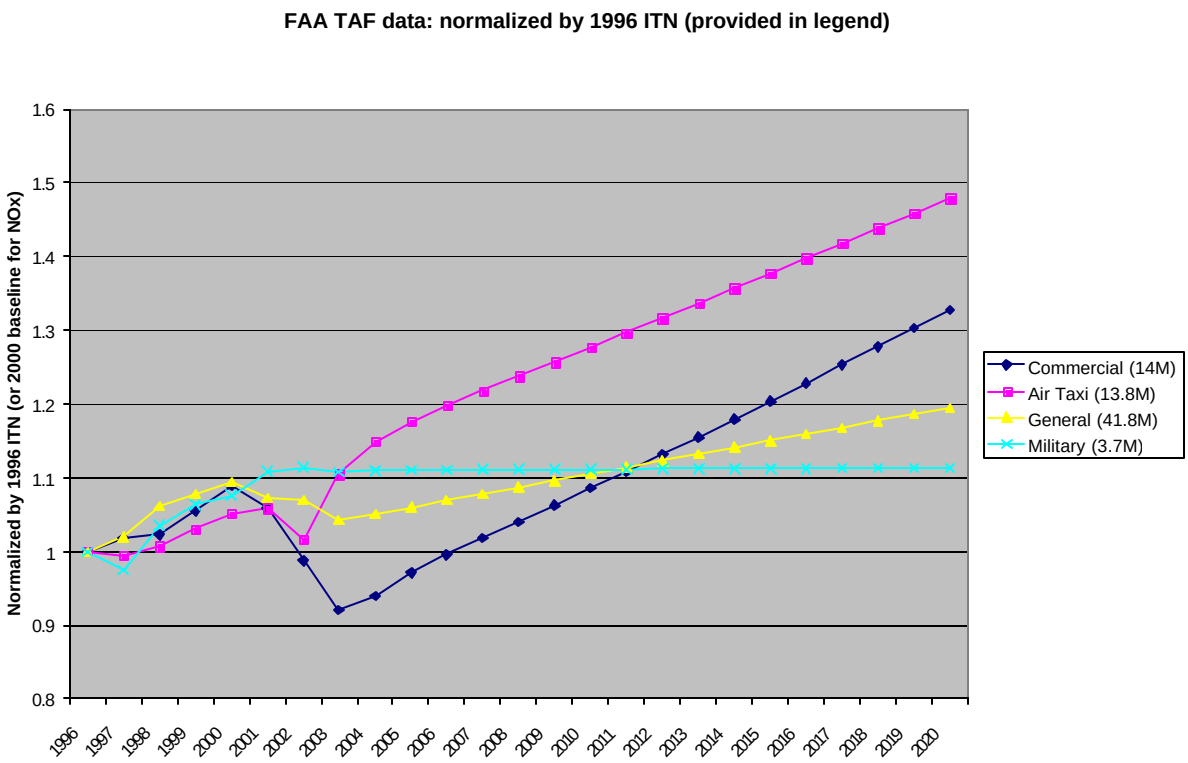

Figure 1. Analysis of TAF data

The amount of NOX reduced due to the recent CAEP standards was not quantified for this analysis since the amount of reduction would be relatively small and resources were limited.

For aircraft refueling (an evaporative emission source), the ITN trend from general aviation will be used because the commercial aircraft use the less volatile fuels.

Approach for Projecting Commercial Marine Vessel emissions:

5) **Base-year Emissions for Commercial Marine Vessels from Diesel and Residual Fuels:** OTAQ stated that their national-level (50-state) CMV diesel and residual fuel emissions should be used to adjust the county-level values in the OAQPS 2001 baseline NEI. OTAQ's national estimates are more up-to-date since they come from the category 3 rule estimates whereas the OAQPS 2001 baseline estimates are from the category 2 rule. There is no state-submitted data in the OAQPS 2001 NEI, so no adjustments need to be made to preserve state-submitted estimates. Because the OTAQ national estimates do not distinguish between port emissions (2280002100) and underway emissions (2280002200), OAQPS will apply the same national-level adjustment ratio for each of these categories within the specific fuel type (residual or diesel). Two separate ratios, per pollutant, will be developed because OTAQ has distinct national-level emission values for residual and diesel fuels. The ratio to be applied to each county-level commercial marine residual SCC (port, underway) in OAQPS' inventory is: OTAQ national (50-state) residual CMV emissions divided by OAQPS national (50-state) residual CMV

emissions. Note that the OAQPS national residual emissions are computed by summing port residual and underway residual emissions across the 50 states. A similar formula, whereby diesel is used in place of residual, is used for the ratios to be computed for diesel emissions. In addition, PM2.5 and PM10 will be adjusted such that PM2.5 is 97% of PM10.

6) **Projected Emissions for Commercial Marine Vessel Emissions from Diesel and Residual**: OAQPS will compute national-level, **pollutant-specific,** projection factors from the OTAQ national-level data for each of the fuel types and apply them to the county-level baseline inventories developed under item 5 above.

7) **Commerical Marine (Other):** OTAQ provided baseline and future year inventories for SCC=228001000 and 228004000 (coal and gasoline, respectively). These inventories are from Pechan and are not deemed as reliable as the inventories for the Diesel and Residual. Furthermore, the OAQPS 2001 NEI does not contain these SCCs. This is because when developing the 2001 NEI, it was assumed that commercial marine vessels utilize primarily diesel or residual fuels; thus, OAQPS did not estimate emissions for ships burning coal and gas. OTAQ agreed that emissions from these categories do not need to be included in the 2001 baseyear NEI or any future year inventories projected from this baseline.

Approach for Projecting Locomotive emissions:

8) **Base-year Emissions for Locomotive Emissions:** OTAQ agreed that the locomotive emission estimates in the 2001 modeling platform (the 2001 NEI) utilize more detailed methods than the methods used to generate the national emissions for the nonroad rulemaking. In particular, The 2001 NEI used category-specific emission factors (EFs), whereas the nonroad rulemaking used fleet-average EFs. The OTAQ values for the nonroad rulemaking actually used more recent EIA fuel data (2001 vs 2000), but the differences do not appear to be significant. Thus, it was decided that the 2001 modeling platform estimates be used as a starting point for both the baseline inventory and future year projections. The PM2.5 emissions will be adjusted to assure that PM2.5 is computed as 97% of PM10 as per the memo from Bruce Cantrell discussed in item 2.

9) Projection Method for locomotive emissions: OAQPS will create national-level pollutant-specific growth factors for locomotive emissions and will apply them uniformly across the specific locomotive source categories in the 2001 NEI that are in the list below:

2285002006
2285002007
2285002008
2285002009
2285002010