

DATE: March 21, 2006

TO: Joan Rohlfs

CC: Mike Clifford, Sunil Kumar, Daivamani Sivasailam

FROM: Eulalie G. Lucas

SUBJECT: Results of Monthly Versus Seasonal Emissions Analysis

I. Introduction

This memo transmits results associated with sensitivity tests conducted by DTP staff to show the difference in emissions based on a set of Mobile model monthly input streams and a set of seasonal input streams, for later use in the preparation of annual inventories associated with SIP planning and for air quality conformity analysis of plans and programs. These tests were conducted in response to a request from Air Agency staff for a complete inventory utilizing the two approaches.

II. Objective

While a four seasons approach was applied in the last conformity assessment, the three seasons approach was selected for this test to better address the effects of two significant inputs: one, Evaluation Month which affects fleet composition, and two, the effects of reformulated gasoline (RFG). These two inputs are applied in the Mobile model as either "1", for a winter run, or "7", a summer run. Adherence to the Mobile guidance was crucial in averaging the inputs of the seasons for the creation of seasonal inputs for a third season and it was also a collaborative effort between DEP and DTP staff. Other factors that might change between January and July, such as temperature and fuel volatility, did not influence the selection of months associated with the three seasons.

III. Seasonal Definitions:

Winter: January thru April
Summer: May thru September
Fall: October thru December

IV. Operations:

A. Development of travel data Vehicle Miles of Travel (VMT).

Adjustment factors developed by DTP staff were applied to base 2002 VMT to convert average annual weekday travel (AAWDT) to Average Daily Travel (ADT). Two sets of factors were developed one set was applied to the annual VMT to produce monthly travel data and another set was developed to produce seasonal VMT. See attachment 1

B. Emission Factors.

1. Apply EPA's fuel program 4 using region-specific fuel specifications for winter and summer months.
2. Develop Averages for fall:
 - Hourly temperatures and associated humidity values were averaged using the same formula developed by DEP staff. See attachment 2
 - Month specific RVP values were used for winter and summer months and weighted averages based on region-specific values for fall months. See attachment 3
 - Diesel and gasoline sulfur content values were applied per winter and summer months values and averaged for fall months. See attachment 4

C. Emissions Calculations

The seasonal emission factors were read into the post-processor and the VMT seasonal adjustments were applied resulting in seasonal emissions estimates.

V. Results

- A. PM 2.5 results are illustrated in table 1 the difference between the difference between the annual and seasonal runs is 0.27%
- B. Precursor NO_x results are shown in Table 2, with a difference of 0.15% between the two approaches.

VI. Conclusion

Using the seasonal approach for the preparation of annual inventories gives the same results as the monthly approach at one fourth of the computer time.

Tables and Attachments

Tables 1 and 2: Emissions Results

Attachment 1: Travel Data

Attachment 2: Seasonal Temperature and Humidity

Attachment 3: Monthly Fuel Inputs

Attachment 4: Seasonal Averages for Fuel Program

Attachment 5: 2002 Running Emission Rates for DC

Table 1 Direct PM 2.5 Results
2002 Network Monthly Emissions vs Seasonal Emissions

Season	Month	Total Trip Cycle		Absolute Difference	Percent Difference
		Tons per month	Tons per season (AQC)		
Winter	Jan	124.93			
	Feb	116.62			
	Mar	132.28			
	Apr	128.01			
	Sub-Total	501.84	504.96	3.13	0.62%
Summer	May	128.34			
	Jun	127.53			
	Jul	130.82			
	Aug	130.60			
	Sep	122.22			
	Sub-Total	639.52	639.85	0.33	0.05%
Fall	Oct	125.80			
	Nov	117.87			
	Dec	121.34			
	Sub-Total	365.01	365.70	0.69	0.19%
Annual		1506.36	1510.51	4.15	0.27%

Table 2: Precursor NOx
2002 Network Monthly Emissions vs Seasonal Emissions

Season	Month	Total Trip Cycle		Absolute Difference	Percent Difference
		Tons per month	Tons per season (AQC)		
Winter	Jan	8720.65			
	Feb	7986.47			
	Mar	8584.93			
	Apr	7996.11			
	Sub-Total	33288.15	33418.44	130.29	0.39%
Summer	May	7526.02			
	Jun	7248.18			
	Jul	7304.96			
	Aug	7297.68			
	Sep	7000.11			
	Sub-Total	36376.96	36303.23	-73.73	-0.20%
Fall	Oct	7804.57			
	Nov	7709.91			
	Dec	8474.56			
	Sub-Total	23989.03	24077.42	88.38	0.37%
Annual		93654.14	93799.09	144.94	0.15%

Attachment 1

Comparison of Monthly and Seasonal VMT's

Daily VMT 121,000,000

		Number	Monthly	AAWDT	Monthly	Number	Seasonal	Seasonal
		of Days	Factor	(1,000s)	VMT (1,000s)	of Days	Factor	VMT (1,000)
	Jan	31	0.880	121000	3,300,880			
	Feb	28	0.912	121000	3,088,495			
Winter	Mar	31	0.934	121000	3,502,147	120	0.92	
	Apr	30	0.959	121000	3,482,220			
				subtotal	13,373,743			13,381,632
	May	31	0.978	121000	3,668,688			
	Jun	30	1.004	121000	3,643,754			
Summer	Jul	31	0.996	121000	3,734,602	153	0.99	
	Aug	31	0.996	121000	3,734,803			
	Sep	30	0.964	121000	3,497,685			
				subtotal	18,279,532			18,277,885
	Oct	31	0.953	121000	3,574,387			
Fall	Nov	30	0.917	121000	3,328,509	92	0.93	
	Dec	31	0.910	121000	3,413,410			
				subtotal	10,316,305			10,332,722
				Annual	41,969,580			41,992,239

Attachment 2a

Spring Season Hourly Temperature and Relative Humidity

Winter/Spring Months (01, 02, 03 and 04)

Hour	Temp	DPT	Cal. RH	NCDC RH	Station Pressure
1	39.8	29.5	66.5	69.1	29.9
2	39.0	29.3	68.0	70.2	29.9
3	38.2	29.1	69.3	71.5	29.9
4	37.6	29.1	71.0	72.8	29.9
5	37.2	29.0	72.0	73.9	29.9
6	36.9	28.9	72.4	74.3	29.9
7	37.4	29.1	71.7	73.7	29.9
8	38.9	29.3	68.2	70.7	29.9
9	41.2	29.7	63.4	66.3	29.9
10	43.4	29.7	58.1	61.2	29.9
11	45.5	29.9	54.2	57.8	29.9
12	47.2	30.0	50.7	54.7	29.9
13	48.6	29.9	48.1	52.4	29.9
14	49.7	30.1	46.5	51.1	29.8
15	50.2	30.0	45.5	50.3	29.8
16	50.2	30.0	45.5	50.4	29.8
17	49.3	30.0	47.1	51.7	29.8
18	47.5	29.8	49.9	54.3	29.8
19	45.8	29.8	53.4	57.2	29.9
20	44.3	30.0	56.9	60.3	29.9
21	43.1	30.0	59.4	62.5	29.9
22	42.3	29.7	60.8	63.9	29.9
23	41.4	29.8	63.0	65.8	29.9
24	40.6	29.8	65.0	67.6	29.9

Attachment 2b

Summer Season Hourly Temperature and Relative Humidity

Summer Months (05, 06, 07, 08 and 09)

Hour	Temp	DPT	Cal. RH	NCDC RH	Station Pressure
1	67.3	61.9	82.5	83.5	29.8
2	66.6	61.5	83.5	84.5	29.8
3	66.2	61.4	84.3	85.5	29.8
4	65.8	61.1	84.7	86.2	29.8
5	65.3	60.9	85.5	86.6	29.8
6	65.7	61.1	85.1	85.9	29.8
7	67.6	61.7	81.0	82.3	29.8
8	69.9	62.2	76.0	77.2	29.9
9	72.3	62.3	70.4	72.2	29.9
10	74.5	62.2	65.1	67.3	29.9
11	76.3	62.0	60.6	63.1	29.8
12	77.9	62.0	57.6	60.1	29.8
13	78.9	61.8	55.2	57.8	29.8
14	79.5	61.6	53.6	56.7	29.8
15	79.5	61.6	53.6	56.9	29.8
16	79.1	61.7	54.5	57.6	29.8
17	78.4	61.7	55.9	59.2	29.8
18	76.9	61.8	59.2	62.1	29.8
19	74.7	62.0	64.2	66.8	29.8
20	72.5	62.3	69.8	71.8	29.8
21	71.2	62.5	73.5	75.6	29.8
22	69.9	62.4	76.7	78.7	29.8
23	68.9	62.3	79.2	80.6	29.8
24	68.0	62.1	81.1	82.2	29.8

Attachment 2c

Fall Season Hourly Temperature and Relative Humidity

Months (October, November and December)

Hour	Temp	DPT	Cal. RH	NCDC RH	Station Pressure
1	44.6	37.5	75.8	77.6	29.9
2	44.1	37.3	76.8	78.4	29.9
3	43.6	37.2	78.1	79.4	29.9
4	43.2	36.8	78.1	80.3	29.9
5	42.7	36.7	79.1	80.3	29.9
6	42.4	36.4	78.9	80.6	29.9
7	42.6	36.4	78.7	80.4	29.9
8	43.9	37.2	77.1	78.9	29.9
9	46.3	37.7	71.6	73.6	29.9
10	48.8	38.0	65.8	68.2	29.9
11	50.7	37.7	60.8	63.3	29.9
12	52.4	37.6	56.6	59.8	29.9
13	53.6	37.4	53.9	57.2	29.9
14	54.2	37.4	52.7	56.3	29.8
15	54.3	37.5	52.6	56.2	29.8
16	53.7	37.6	53.9	57.6	29.8
17	52.0	37.4	57.2	60.4	29.9
18	50.1	37.6	61.7	64.6	29.9
19	48.8	37.7	65.1	67.8	29.9
20	47.7	37.6	67.5	70.1	29.9
21	46.9	37.9	70.4	72.4	29.9
22	46.3	37.7	71.6	74.0	29.9
23	45.6	37.6	73.4	75.5	29.9
24	45.0	37.6	74.9	76.6	29.9

**Attachment 3
Monthly Fuel and RVP Values**

Month	DC		DC	Washington, DC-MD-VA Mobile Modeling Area RFG Counties			
	Gasoline Sulfur	RVP	Highway Diesel Sulfur	Ether Oxy. Content (% by wt)	Ether Market Share (%)	Oxy. Content (%)	Ethanol Market Share (%)
Jan	230.0	13.1	324	1.5	70	3.5	30
Feb	199.57	10.4	324	1.5	70	3.5	30
Mar	199.57	10.4	326	1.5	70	3.5	30
Apr	159.0	6.8	326	1.5	70	3.5	30
May	159.0	6.8	326	2.1	100	0	0
Jun	159.0	6.8	329	2.1	100	0	0
Jul	159.0	6.8	329	2.1	100	0	0
Aug	159.0	6.8	329	2.1	100	0	0
Sep	159.0	6.8	326	2.1	100	0	0
Oct	159.0	6.8	326	1.5	70	3.5	30
Nov	199.57	10.4	326	1.5	70	3.5	30
Dec	230.0	13.1	324	1.5	70	3.5	30

Month	VA - RFG Counties		VA - Non-RFG Counties		VA - All Counties	Wash, DC-MD-VA Mobile Modeling Area RFG Counties			
	Gasoline Sulfur	RVP	Gasoline Sulfur	RVP	Highway Diesel Sulfur	Ether Oxy. Content (% by wt)	Market Share	Oxy. Content	Ethanol Market Share (%)
Jan	279.0	12.9	Conventional Gasoline East Values	12.9	330	1.5	70	3.5	30
Feb	279.0	12.9		12.9	330	1.5	70	3.5	30
Mar	279.0	12.9		12.9	344	1.5	70	3.5	30
Apr	279.0	12.9		12.9	344	1.5	70	3.5	30
May	129.0	6.7		8.4	344	2.1	100	0	0
Jun	129.0	6.7		8.4	357	2.1	100	0	0
Jul	129.0	6.7		8.4	357	2.1	100	0	0
Aug	129.0	6.7		8.4	357	2.1	100	0	0
Sep	129.0	6.7		8.4	344	2.1	100	0	0
Oct	279.0	12.9		12.9	344	1.5	70	3.5	30
Nov	279.0	12.9		12.9	344	1.5	70	3.5	30
Dec	279.0	12.9		12.9	330	1.5	70	3.5	30

Month	MD - RFG Counties		MD - Non-RFG Counties		MD - All Counties	Washington, DC-MD-VA Mobile Modeling Area RFG Counties			
	Gasoline Sulfur	RVP	Gasoline Sulfur	RVP	Highway Diesel Sulfur	Ether Oxy. Content (% by wt)	Market Share	Oxy. Content	Ethanol Market Share (%)
Jan	279.0	12.9	Conventional Gasoline East Values	12.9	477	1.5	70	3.5	30
Feb	279.0	12.9		12.9	478	1.5	70	3.5	30
Mar	279.0	12.6		12.6	500	1.5	70	3.5	30
Apr	279.0	11.0		11.0	467	1.5	70	3.5	30
May	129.0	7.5		7.5	481	2.1	100	0	0
Jun	129.0	6.7		8.4	480	2.1	100	0	0
Jul	129.0	6.5		8.2	500	2.1	100	0	0
Aug	129.0	6.6		8.1	455	2.1	100	0	0
Sep	129.0	7.2		7.2	464	2.1	100	0	0
Oct	279.0	10.0		10.0	469	1.5	70	3.5	30
Nov	279.0	11.3		11.3	491	1.5	70	3.5	30
Dec	279.0	12.2		12.2	484	1.5	70	3.5	30

Attachment 4

Seasonal Values for fuel parameters and RVP

	DC			
	Gas S	Diesel S	RVP	
Winter	197.0	325.0		12.9
Summer	159.0	327.8		6.7
Fall	196.2	325.3		12.9

	MD		MD - NonRFG	
Gas S	Diesel S	RVP	RVP	
279.0	480.5	12.4		12.4
129.0	476.0	6.9		7.9
279.0	481.3	11.2		11.2

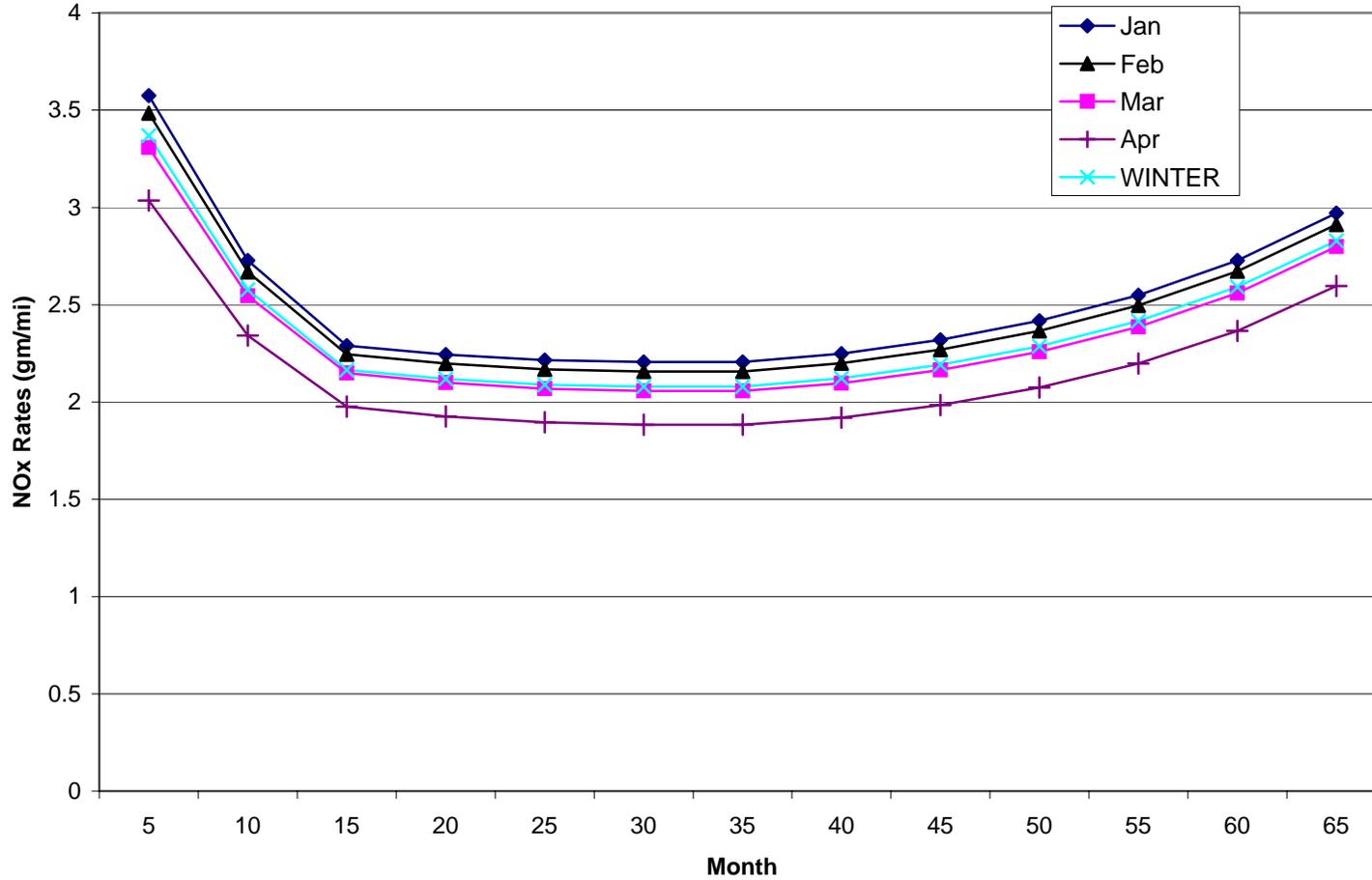
	VA		VA - NonRFG	
Gas S	Diesel S	RVP	RVP	
279.0	337.0	12.9		12.9
129.0	351.8	6.7		8.4
279.0	339.3	12.9		12.9

Ether Oxy. Cor Ether Market Sr Ethanol Oxy. Cc Ethanol Market Share (%)

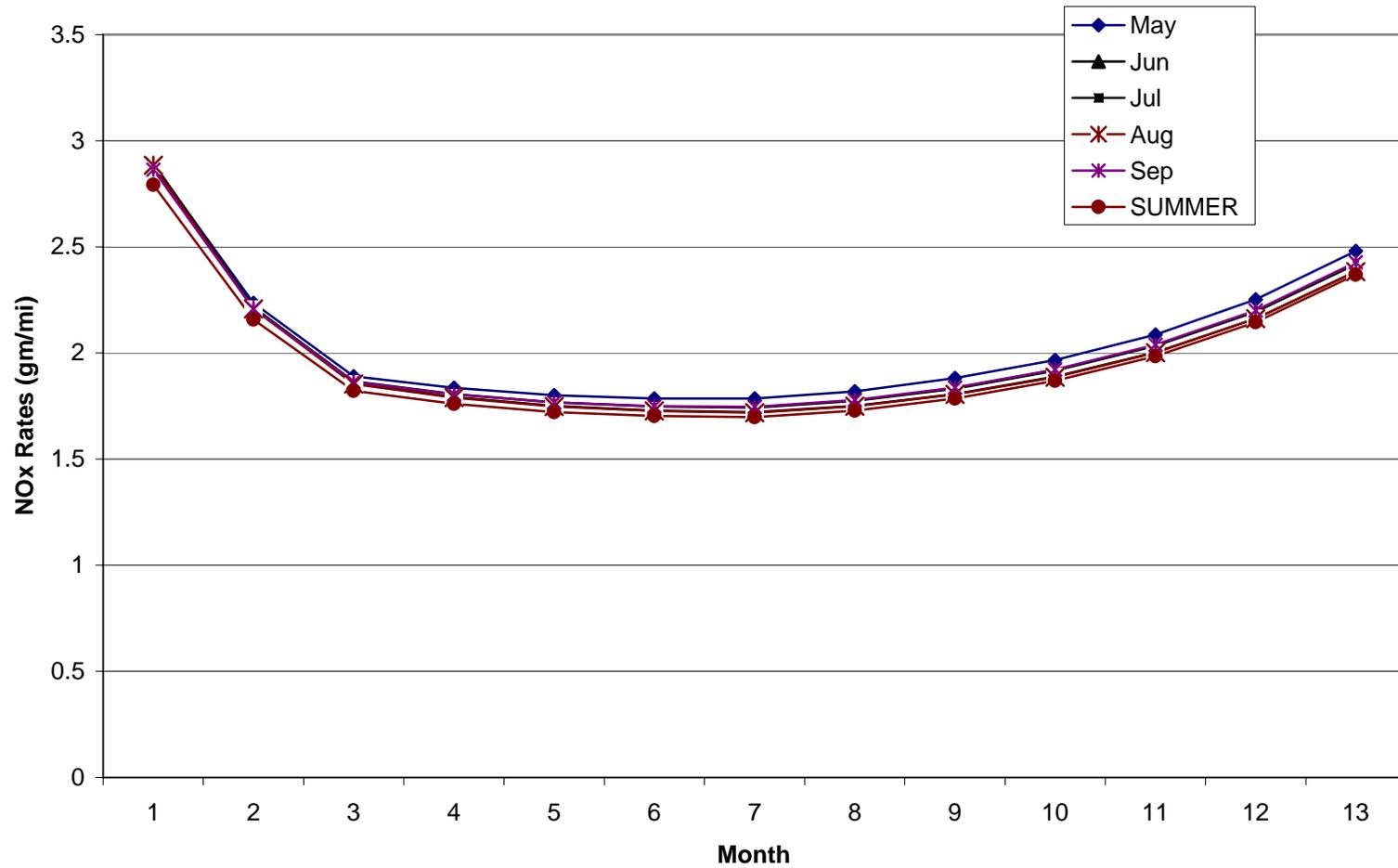
1.5	70	3.5	30
2.1	100	0	0
1.5	70	3.5	30

Average of monthly values

Attachment 5a
2002 Mobile Rates Nox Rates by Month
at Varying Speeds for DC Freeways
Reg Inputs



Attachment 5b
2002 Mobile Rates Nox Rates by Month
at Varying Speeds for DC Freeways
Reg Inputs



Attachment 5c
2002 Mobile Rates Nox Rates by Month
at Varying Speeds for DC Freeways
Reg Inputs

