U.S. Department of Homeland Security
Nebraska Avenue Complex Master Plan
DRAFT ENVIRONMENTAL IMPACT STATEMENT

APPENDIX D

January 14, 2011

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Vehicle Emissions Calculations: Alt A

Total MV Emissions in Anne Arundel County (tons/year)

Vehicle Type	total VMT (millions)	HC (VOC)	CO	NOx	SO2	PM2.5	PM10
LDGV	2,347.88	1,348.61	23,065.09	1,310.07	17.58	29.30	64.28
LDGT12	550.88	176.28	4,535.98	226.68	5.34	6.88	15.08
HDDV2B - Trucks	46.50	7.33	32.30	173.15	1.08	3.92	4.90
HDDBT - Buses	16.94	6.66	58.79	292.14	1.17	5.66	6.43

Backcalculated Emission Factors (tons/million VMT) lbs/mile

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.57	9.82	0.56	0.01	0.01	0.03	0.96
0.32	8.23	0.41	0.01	0.01	0.03	0.96
0.16	0.69	3.72	0.02	0.08	0.11	
0.39	3.47	17.25	0.07	0.33	0.38	

Backcalculated Emission Factors (lbs/mile)

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.00114879	0.0196476	0.001116	1.5E-05	2.5E-05	5.4756E-05	0.96

Alt A

Projected NAC Total Trips by Vehicle Type

Vehicle Type	Trips/day	RT/day	Days/ year	Miles/trip	total VMT	Million VMT
LDGV	3800	2	260	13	25,688,000	25.688
LDGT	0	2	260	0	0	0
Delivery Trucks HDDV2B	6	2	260	25	78,000	0.078
Buses - HDDBT	0	2	260	40	0	0

Vehicle Emissions Calculations: Alt A

Total Emissions (tons)

	VOC	CO	Nox	SO2	PM2.5	PM10	CO2	CO2 metric tons
	14.76	252.35	14.33	0.19	0.32	0.70	12,275	11,133
	0.00	0.00	0.00	0.00	0.00	0.00	0	
	0.01	0.05	0.29	0.00	0.01	0.01		
	0.00	0.00	0.00	0.00	0.00	0.00		
TOTALS:	**14.8**	**252.4**	**14.6**	**0.2**	**0.3**	**0.7**	**12,275**	**11,133**

CO2 Metric Tons Factor	0.907

Note: CO2 emission estimates are from USEPA Fact Sheet - GHG Emissions from a Typical Passenger Vehicle (February 2005)

Backcalculations of Emission Factors from Baltimore Non-Attainment Area PM2.5 SIP - March 24, 2008

VMT and Emissions from Anne Arundel County, based on 2005 vehicle mix

Miles/trip for LDGV (commuters) from Transportation Research Board report "Commuting in America" - chart: Average Work Trip Length by Metropolitan Area Size

Vehicle Emissions Calculations: Alt B

Total MV Emissions in Anne Arundel County (tons/year)

Vehicle Type	total VMT (millions)	HC (VOC)	CO	NOx	SO2	PM2.5	PM10
LDGV	2,347.88	1,348.61	23,065.09	1,310.07	17.58	29.30	64.28
LDGT12	550.88	176.28	4,535.98	226.68	5.34	6.88	15.08
HDDV2B - Trucks	46.50	7.33	32.30	173.15	1.08	3.92	4.90
HDDBT - Buses	16.94	6.66	58.79	292.14	1.17	5.66	6.43

Backcalculated Emission Factors (tons/million VMT) lbs/mile

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.57	9.82	0.56	0.01	0.01	0.03	0.96
0.32	8.23	0.41	0.01	0.01	0.03	0.96
0.16	0.69	3.72	0.02	0.08	0.11	
0.39	3.47	17.25	0.07	0.33	0.38	

Backcalculated Emission Factors (lbs/mile)

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.00114879	0.0196476	0.001116	1.5E-05	2.5E-05	5.4756E-05	0.96

Alt B

Projected NAC Total Trips by Vehicle Type

Vehicle Type	Trips/day	RT/day	Days/year	Miles/trip	total VMT	Million VMT
LDGV	4200	2	260	13	28,392,000	28.392
LDGT	0	2	260	40	0	0
Delivery Trucks HDDV2B	6	2	260	25	78,000	0.078
Buses - HDDBT	0	2	260	40	0	0

Vehicle Emissions Calculations: Alt B

	Total Emissions (tons)							
	VOC	CO	Nox	SO2	PM2.5	PM10	CO2	CO2 metric tons
	16.31	278.92	15.84	0.21	0.35	0.78	13,567	12,305
	0.00	0.00	0.00	0.00	0.00	0.00	0	
	0.01	0.05	0.29	0.00	0.01	0.01		
	0.00	0.00	0.00	0.00	0.00	0.00		
TOTALS:	**16.3**	**279.0**	**16.1**	**0.2**	**0.4**	**0.8**	**13,567**	**12,305**

CO2 Metric Tons Factor	0.907

Note: CO2 emission estimates are from USEPA Fact Sheet - GHG Emissions from a Typical Passenger Vehicle (February 2005)

Backcalculations of Emission Factors from Baltimore Non-Attainment Area PM2.5 SIP - March 24, 2008

VMT and Emissions from Anne Arundel County, based on 2005 vehicle mix

Miles/trip for LDGV (commuters) from Transportation Research Board report "Commuting in America" - chart: Average Work Trip Length by Metropolitan Area Size

Vehicle Emissions Calculations: Alt C

Total MV Emissions in Anne Arundel County (tons/year)

Vehicle Type	total VMT (millions)	HC (VOC)	CO	NOx	SO2	PM2.5	PM10
LDGV	2,347.88	1,348.61	23,065.09	1,310.07	17.58	29.30	64.28
LDGT12	550.88	176.28	4,535.98	226.68	5.34	6.88	15.08
HDDV2B - Trucks	46.50	7.33	32.30	173.15	1.08	3.92	4.90
HDDBT - Buses	16.94	6.66	58.79	292.14	1.17	5.66	6.43

Backcalculated Emission Factors (tons/million VMT) lbs/mile

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.57	9.82	0.56	0.01	0.01	0.03	0.96
0.32	8.23	0.41	0.01	0.01	0.03	0.96
0.16	0.69	3.72	0.02	0.08	0.11	
0.39	3.47	17.25	0.07	0.33	0.38	

Backcalculated Emission Factors (lbs/mile)

VOC	CO	Nox	SO2	PM2.5	PM10	CO2
0.00114879	0.0196476	0.001116	1.5E-05	2.5E-05	5.4756E-05	0.96

Alt C

Projected NAC Total Trips by Vehicle Type

Vehicle Type	Trips/day	RT/day	Days/year	Miles/trip	total VMT	Million VMT
LDGV	4500	2	260	13	30,420,000	30.42
LDGT	0	2	260	40	0	0
Delivery Trucks HDDV2B	6	2	260	25	78,000	0.078
Buses - HDDBT	0	2	260	40	0	0

Vehicle Emissions Calculations: Alt C

	Total Emissions (tons)							
	VOC	CO	Nox	SO2	PM2.5	PM10	CO2	CO2 metric tons
	17.47	298.84	16.97	0.23	0.38	0.83	14,536	13,184
	0.00	0.00	0.00	0.00	0.00	0.00	0	
	0.01	0.05	0.29	0.00	0.01	0.01		
	0.00	0.00	0.00	0.00	0.00	0.00		
TOTALS:	**17.5**	**298.9**	**17.3**	**0.2**	**0.4**	**0.8**	**14,536**	**13,184**

CO2 Metric Tons Factor	0.907

Note: CO2 emission estimates are from USEPA Fact Sheet - GHG Emissions from a Typical Passenger Vehicle (February 2005)

Backcalculations of Emission Factors from Baltimore Non-Attainment Area PM2.5 SIP - March 24, 2008

VMT and Emissions from Anne Arundel County, based on 2005 vehicle mix

Miles/trip for LDGV (commuters) from Transportation Research Board report "Commuting in America" - chart: Average Work Trip Length by Metropolitan Area Size

Estimated Emissions from Offsite Electricity Generation

Alternative	Total Building Square Footage (s.f.)	Electricity Intensity per Total Floor Area (MJ/m^2)	Electricity Intensity per Total Floor Area (kwh/sf)	Total Projected Electricity Usage (MW-hr)
No Action	653,400	385.45	10.0	6,507
A	1,072,720	385.45	10.0	10,683
B	1,220,450	385.45	10.0	12,154
C	1,309,090	385.45	10.0	13,037

Emission Factors (lb/MW-hr)

VOC	CO	NOx	SO2	PM	CO2
n/a	n/a	1.63	7.79	n/a	1,139
n/a	n/a	1.63	7.79	n/a	1,139
n/a	n/a	1.63	7.79	n/a	1,139
n/a	n/a	1.63	7.79	n/a	1,139

Abbreviations:
kwh = kilowatt-hour
MJ = mega Joule
MW-hr = megawatt-hour
n/a = not available
s.f. = square feet

Estimated Emissions from Offsite Electricity Generation

	Emissions (tons/year)						
Alternative	**VOC**	**CO**	**NOx**	**SO2**	**PM**	**CO2**	**CO2 metric tons**
No Action	n/a	n/a	5.3	25.3	n/a	3,706	3,361
A	n/a	n/a	8.7	41.6	n/a	6,084	5,518
B	n/a	n/a	9.9	47.3	n/a	6,922	6,278
C	n/a	n/a	10.6	50.8	n/a	7,424	6,734

Estimated electricity usage per total floor area from U.S. Department of Energy, Energy Efficiency and Renewable Energy Website

Benchmark models by climate zone and city, for small office, Baltimore, MD.

Emission factors from eGRID Subregion RFC East

Estimated Emissions from Emergency Generator - 2MW

Table 1
Estimated Annual Hours of Operation:

Mode	Run Time (hours)	Frequency of Event	Total Hours of Operation
Weekly Generator Testing	0.5	40	20
Monthly Generator Testing	1	12	12
Emergency Operations	48	1	48
		Estimated Maximum Hours/year:	**80**

Horsepower Calculations (1 generator)

Total Horsepower (hp)	Total Hours of Operation (hr)	Total horsepower-hours (hp-hr)
2,680	80	214,400

Emission Factors (lb/hp-hr)

TOC	CO	NOx	SO2	PM	CO2
0.0007	0.0055	0.024	0.0004045	0.0007	1.16

Emissions (tons/year) for 1 generator

TOC	CO	NOx	SO2	PM	CO2
0.08	0.59	2.57	0.04	0.08	124.35

Emissions (tons/year) for 3 generators

TOC	CO	NOx	SO2	PM	CO2
0.23	1.77	7.72	0.13	0.23	373.06

Emission factors from AP-42 Section 3.4, Table 3.4-1. Large stationary diesel engines.

Assumptions: Diesel Generator = 2 Megawatts (MW) power output = 2,680 horsepower
Assumes uncontrolled emissions (SCR typically not cost effective for emergency generators)

Estimated Emissions from Emergency Generator - 500 kW

Estimated Annual Hours of Operation:

Mode	Run Time (hours)	Frequency of Event	Total Hours of Operation
Weekly Generator Testing	0.5	40	20
Monthly Generator Testing	1	12	12
Emergency Operations	48	1	48
		Estimated Maximum Hours/year:	**80**

Horsepower Calculations (1 generator)

Total Horsepower (hp)	Total Hours of Operation (hr)	Total horsepower-hours (hp-hr)
670	80	53,600

Emission Factors (lb/hp-hr)

TOC	CO	NOx	SO2	PM	CO2
0.0007	0.0055	0.024	0.0004045	0.0007	1.16

Emissions (tons/year) for 1 generator

TOC	CO	NOx	SO2	PM	CO2
0.02	0.15	0.64	0.01	0.02	31.09

Emission factors from AP-42 Section 3.4, Table 3.4-1. Large stationary diesel engines (above 600 hp).

Assumptions: Diesel Generator = 500 Kilowatts (kW) power output = 670 horsepower
Assumes uncontrolled emissions (SCR typically not cost effective for emergency generators)