APPENDIX B: AIR QUALITY ANALYSIS

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APPENDIX B: AIR QUALITY ANALYSIS

An impact study was performed to assess air quality effects resulting from construction and operation of the proposed actions, including stationary sources, mobile sources and parking facilities. This study provides findings on ambient air quality concentrations and compliance with the regulations and standards promulgated by the Clean Air Act and Amendments (CAAA), and regulations found in the Code of Maryland Regulations (COMAR). The project design, build scenario and traffic data utilized in air analysis are consistent with the information used in the traffic study for the proposed project.

An air quality applicability analysis was conducted to identify potential increases or decreases in criteria air pollutant emissions associated with the proposed construction at National Navy Medical Center, Maryland (NNMC). The project will occur within a U.S. Environmental Protection Agency (USEPA) designated moderate nonattainment zone for ozone and nonattainment for particulate matter (2.5 microns) and is subject to the federal conformity requirements. The area is also a maintenance area for carbon monoxide (CO). The purpose of this analysis is to apply the Federal General Conformity Rule established in 40 CFR, Part 93 entitled: *Determining Conformity of Federal Actions to State or Federal Implementation Plans* to the Proposed Action Alternative in order to determine any effect on air quality.

The federal conformity rules were established to ensure that federal activities do not hamper local efforts to control air pollution. In particular, Section 176(c) of the Clean Air Act (CAA) prohibits federal agencies, departments or instrumentalities from engaging in, supporting, licensing, or approving any action, in an area that is in nonattainment of the National Ambient Air Quality Standards (NAAQS), which does not conform to an approved state or federal implementation plan. Therefore, the agency must determine whether or not the project would interfere with the clean air goals in the State Implementation Plan (SIP).

1.0 Project Description

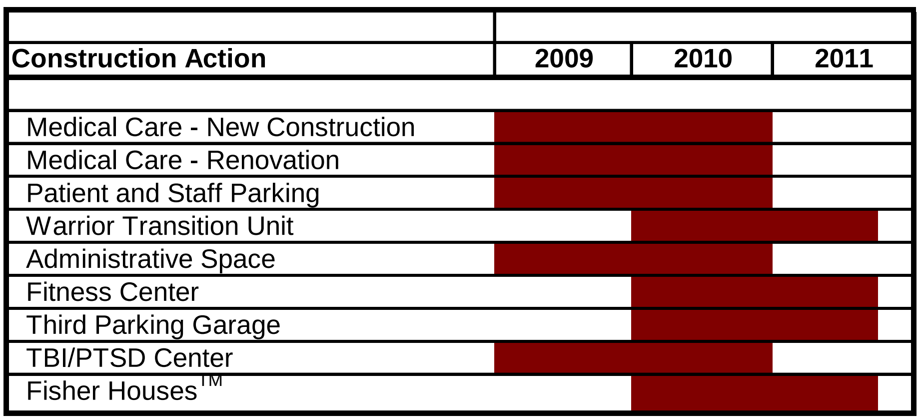
Alternatives One and Two consist of all BRAC-related construction. The two alternatives only vary the location of building sites, not the overall square footage of construction; however, demolition and renovation differs between the two alternatives.

Both alternatives also follow the same construction schedule. Emissions have been estimated based on square footage for construction, demolition, and operations and are based on an assumed construction schedule as shown in Figure B-1. All projects follow a two-year schedule, except the north and south parking garages and renovation, which are assumed to require one year each. During the first year of any given project, relevant demolition and ground surfacing equipment would be used. During the second year, the heavy equipment related to raising the structures would be used in combination with delivery trucks and other equipment used to complete the building's interior. North parking and the south parking garage each have demolition and construction in one year, while the third parking garage has its demolition in one year followed by erection in the following year. Clinical space-related renovation is broken out into two years, while BEQ and administrative renovation is assumed to occur in the final year of their respective projects.

Actual construction dates could vary from these dates; these assumptions were chosen to maximize the potential emissions in any given year for a conservative estimate. Should the construction be spread over more years, the annual emissions would be expected to be less. All construction is expected to be completed by September 2011.

Figure B-1 graphically portrays the assumed timing of construction activities.

FIGURE B-1: CONSTRUCTION TIMELINE – ALTERNATIVES 1 & 2



2.0 Meteorology/Climate

Temperature is a parameter used in calculations of emissions for air quality applicability. Climate at National Naval Medical Center can be characterized as a humid, continental climate with a mean high temperature of 89°F in July and a mean low temperature of 24°F in January. The average temperature is 56.5°F. Summers are warm with periods of high humidity and winters are cold, with periods of snow cover (City-Data, ND).

3.0 Current Ambient Air Quality Conditions

NNMC is located in Montgomery County, Maryland. The USEPA has classified the area of the proposed action as in nonattainment for $PM_{2.5}$ and in moderate nonattainment for ozone. The county was previously in nonattainment for CO but came into attainment in 1996. The county is in maintenance for CO. The county is in attainment for all other criteria pollutants.

4.0 Air Quality Regulatory Requirements

4.1 General Conformity Applicability Analysis

The USEPA defines ambient air in 40 CFR Part 50 as "that portion of the atmosphere, external to buildings, to which the general public has access." In compliance with the 1970 Clean Air Act (CAA) and the 1977 and 1990 Clean Air Act Amendments (CAAA), the USEPA has promulgated National Ambient Air Quality Standards (NAAQS). The NAAQS were enacted for the protection of the public health and welfare, allowing for an adequate margin of safety. To date, the USEPA has issued NAAQS for six criteria pollutants: carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter (particles with a diameter less than or equal to a nominal 10 micrometers (PM_{10}) and particles with a diameter less than or equal to nominal 2.5 micrometers ($PM_{2.5}$)), ozone (O_3), nitrogen oxides (NO_x), and lead (Pb). NO_x is both nitrogen dioxide (NO_2) and nitrogen trioxide (NO_3), measured as NO_2 equivalents. Federal regulations designate Air-Quality Control Regions (AQCRs) in violation of the NAAQS as nonattainment areas. According to the severity of the pollution problem, nonattainment areas can be categorized as marginal, moderate, serious, severe, or extreme. Severity categories have not been applied to $PM_{2.5}$ nonattainment areas. The USEPA has classified the Metropolitan Washington, DC area (AQCR 47), which includes Montgomery County and NNMC, as in moderate nonattainment for the 8-hour ozone NAAQS and in nonattainment for $PM_{2.5}$. It is in maintenance for CO. A maintenance area is an attainment area that was previously in nonattainment. Threshold levels for a maintenance area pollutant are monitored to ensure continued attainment in that airshed. AQCR 47 came into attainment for CO on 15 March, 1996.

The NAAQS for ozone, CO, and $PM_{2.5}$ are shown in Table B-1.

TABLE B-1: NATIONAL AMBIENT AIR QUALITY STANDARDS FOR OZONE, $PM_{2.5}$ AND CO

Pollutant	Federal Standard	Maryland Standard
Ozone (O_3)* 8-Hour Average	0.08 ppm	0.08 ppm
Particulate Matter ($PM_{2.5}$)*		
24-Hour Average	35 μg/m^3	65 μg/m^3
Annual Geometric Mean	15 μg/m^3	15 μg/m^3
Carbon Monoxide (CO)**		
1-Hour Average	35 ppm	35 ppm
8-Hour Average	9 ppm	9 ppm

* Federal primary and secondary standards for this pollutant are identical.

** There are no secondary standards for this pollutant.
(Sources: USEPA, 2006; MDE, 2002)

AQCR 47 is also in an ozone transport region; it in attainment for all other criteria pollutants. In December 2006, a federal appellate court remanded the USEPA’s 8-hour ozone standard. No final decision has been reached on the outcome for this decision. On 3 October, 2007, the EPA issued a memo stating that for New Source Review, AQCRs will be held to the 1-hour ozone standard regulations (EPA, 2007d). This ruling does not effect the General Conformity Analysis at this time.

To regulate the emission levels resulting from a project, federal actions located in nonattainment areas are required to demonstrate compliance with the general conformity rule established in 40 CFR Part 93 Determining Conformity of Federal Actions to State or Federal Implementation Plans (the Rule). The project area is located within a nonattainment area; therefore, a General Conformity Rule applicability analysis is warranted.

Section 93.153 of the Rule sets applicability requirements for projects subject to the Rule through establishment of *de minimis* levels for annual criteria pollutant emissions. These *de minimis* levels are set according to criteria pollutant nonattainment area designations. For projects below the *de minimis* levels, a full conformity determination is not required. Those at or above the levels are required to perform a conformity determination as established in the Rule. The *de minimis* levels apply to emissions that can occur during the construction and operation phases of the action.

NNMC has completed a General Conformity Rule applicability analysis in order to analyze any impact to air quality. For ozone, emissions have been estimated for the ozone precursor pollutants NO_x and volatile organic compounds (VOCs). Annual emissions for these compounds were estimated for each of the project actions (construction and operations) to determine if they would be below or above the *de minimis* levels established in the Rule. The *de minimis* threshold for moderate ozone nonattainment areas in an ozone transport region is 100 tons per year (TPY) for NO_x and 50 TPY for VOCs. Montgomery County is also in maintenance for CO and therefore the maintenance *de minimis* level for CO is 100 TPY.

On July 11, 2006 USEPA established *de minimis* levels for $PM_{2.5}$. The final rule established 100 TPY as the *de minimis* emission level under nonattainment for directly emitted $PM_{2.5}$ and each of the precursors that form it (SO_2, NO_x, VOC, and ammonia). This 100 TPY threshold applies separately to each precursor. This means that if an action’s direct or indirect emissions of $PM_{2.5}$, SO_2, NO_x, VOC, or ammonia exceed 100 TPY, a General Conformity determination would be required. Under the current EPA policy for addressing $PM_{2.5}$ precursors, only $PM_{2.5}$ and SO_2 must be evaluated in all regions. States are not required to evaluate VOC, NO_x, or ammonia unless the State or EPA make a technical demonstration that those particular emissions from sources within the State significantly contribute to $PM_{2.5}$ concentrations in a given nonattainment area (EPA, 2007e). Neither USEPA nor Maryland have found $PM_{2.5}$ problems in AQCR 47 to be caused by NO_x, VOCs, or ammonia. Ammonia is not further addressed by the EIS (NO_x and VOCs are addressed as ozone precursors).

Sources of NO_x, VOCs, $PM_{2.5}$, and SO_2 associated with the proposed project would include emissions from construction and demolition equipment, fugitive dust ($PM_{2.5}$), painting of interior building surfaces, and parking spaces (VOCs only), and emissions from stationary units (boilers and generators).

In addition to the evaluation of air emissions against *de minimis* levels, emissions are also evaluated for regional significance. A federal action that does not exceed the threshold emission rates of criteria pollutants may still be subject to a general conformity determination if the direct and indirect emissions from the action exceed ten-percent of the total emissions inventory for a particular criteria pollutant in a nonattainment area. If the emissions exceed this ten-percent threshold, the federal action is considered to be a "regionally significant" activity, and thus, the general conformity rules apply.

4.2 Prevention of Significant Deterioration (PSD)

Major stationary source modifications to NNMC would trigger PSD if they result in a net emissions increase above the following levels: CO, 100 TPY; NO_x, 40 TPY; SO_2, 40 TPY; PM_{10}, 15 TPY; VOC, 40 TPY; Lead, 0.6 TPY. As evidenced by Section 5.2.2, PSD levels are not exceeded by any of the new project stationary sources at NNMC.

5.0 Conformity Applicability Analysis

This project construction- and operations-related General Conformity analysis was performed for the proposed action at NNMC. This conformity analysis and air emissions evaluation will follow the criteria regulated in *40 CFR Parts 51, and 93, Determining Conformity of General Federal Actions to State or Federal Implementation Plans; Final Rule* (November 30, 1993). The emissions evaluation will also follow all NEPA-related criteria regulated in *40 CFR Part 6*.

5.1 Construction Phase Emissions

Construction emissions would result from the operation of heavy equipment, delivery trucks, and the painting of the building structures and parking spaces. The project would utilize a mix of heavy equipment for construction, mainly associated with preparing the site for the buildings and utility relocation.

5.1.1 Emissions from Heavy Equipment

Annual emissions were calculated for various types of diesel construction vehicles using model emission rate input for the year 2008 in USEPA's *Nonroad 2005 Emission Inventory Model: Diesel Construction Equipment, Montgomery County, Maryland* (USEPA, 2005). Truck emission levels were calculated using USEPA's *MOBILE6* model for conditions in July 2008 (USEPA, 2006). The total annual emissions in TPY were determined for each vehicle type based on the number of operating hours per year per vehicle type. (See Section 1.0 of this document to view the construction schedule.)

For both alternatives, it was assumed that delivery trucks would travel 20 miles per trip, making three trips a day, for a total of 60 miles a day.

- Pick-up trucks would be used mainly by site foremen. There would be two at each site and are assumed to travel 5 miles per day around the construction sites.

- Water tankers are assumed to have 20 miles per day of operation.

Emissions factors used for construction vehicles, under all alternatives, are shown in Table B-2.

TABLE B-2: EMISSIONS FACTORS FOR CONSTRUCTION VEHICLES

Construction Vehicle Type	Emissions Factors (lbs/hr)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Chipping Machine	1.169	0.119	0.114	0.165	0.908
Front End Loader	3.402	0.204	0.194	0.496	0.866
Chain Saws	0.208	0.029	0.025	0.037	0.150
Excavator	2.763	0.204	0.149	0.529	1.157
Dozer	2.714	0.199	0.180	0.496	0.818
Pneumatic Tire Roller	0.927	0.099	0.090	0.156	0.792
Steel Wheel Roller	0.927	0.099	0.090	0.156	0.792
Asphalt Paver	1.284	0.100	0.082	0.215	0.483
Vibratory Roller	1.466	0.116	0.105	0.240	0.493
Grader	1.513	0.121	0.107	0.265	0.511
Scraper	5.190	0.280	0.255	0.827	1.974
Concrete Pumper Truck	2.941	0.237	0.101	0.331	0.547
Concrete Truck	2.941	0.237	0.101	0.331	0.547
Crane	1.156	0.116	0.099	0.182	0.575
Backhoe	1.470	0.353	0.322	0.213	1.681
Water Tanker*	9.984	0.242	0.242	0.0132	1.529
Dump Truck*	9.984	0.242	0.324	0.0132	1.529
Pick-Up Truck*	1.22	1.304	1.444	0.0088	22.620
Delivery Truck (Medium)*	1.069	0.306	0.239	0.003	0.877
Delivery Truck (Heavy)*	6.488	0.713	0.453	0.0056	0.746
Air Compressor	0.558	0.049	0.051	0.093	0.221

* units are in grams/mile

Calculations for Construction Emissions

Using the emissions factors in Table B-2, construction emissions were calculated for the proposed construction at NNMC. Using the assumptions described above, the emissions in tons of NO_x, VOC, $PM_{2.5}$, CO, and SO_2 for construction equipment emissions were calculated for each vehicle type using the appropriate equations displayed in Table B-3.

TABLE B-3: EQUATIONS FOR CONSTRUCTION EMISSIONS CALCULATIONS

Emission Source	Equation	Sample Calculation
Heavy Equipment Emissions, Hourly On-Site Activities	(# of vehicle type) (Emission factor) (Total # of days in operation) (hours/day) (1 ton/2000 lbs) = tons of air emissions	(1 grader) (1.513 lbs/hr) (14 days in operation) (8 hours/day) (1 ton/2000 lbs) = **0.08 tons of NO_x of equipment emissions**
Construction Truck Emissions with Vehicle-miles	(# vehicle type) (Emission factor) (Total # of miles traveled during a specific construction activity) (miles/day)(1 ton/2000 lbs) = tons of air emissions	(1 dump truck) (9.984 grams/mile) (27,397 miles total during demolition)(1 lb/453.59 grams) (1 ton/2000 lb) = **0.302 tons NO_x of vehicle emissions**

Surface Disturbance (Fugitive $PM_{2.5}$)

The quantity of dust emissions of $PM_{2.5}$ from construction operations is assumed proportional to the days of construction activity on unpaved surfaces. The following sources for emission factors, with a capture fraction of 50% and silt and moisture contents of 20%, were used in $PM_{2.5}$ emission calculations for fugitive emissions (AP-42 Section 13.2; USEPA, 2006).

- The unpaved road equation 13.2.2.1 equation 1a (AP-42 Chapter 13.2.2) is used to estimate fugitive emissions for the concrete pumper truck, concrete truck, crane, water truck, dump truck pickup truck, and delivery truck. Mileage on unpaved surface for each day of operation by vehicle type is estimated, then multiplied by the number of construction days.
- Front end loader and backhoe emissions combine unpaved road travel from equation 13.2.2.1 equation 1a and the dumping equation from AP-42 Chapter 11, Chapter 11.9-4.
- Dozer, pneumatic tire roller, and vibratory roller emissions are based on the dozer equation from AP-42 Chapter 11, Table 11.9-1.
- Grader emissions are based on the grader equation from AP-42 Chapter 11, Table 11.9-1.

Resultant emission rates in lb/day are presented in Table B-4 and resultant tons of $PM_{2.5}$ emissions are provided in Table B-5.

TABLE B-4: FUGITIVE $PM_{2.5}$ EMISSION FACTORS FOR CONSTRUCTION VEHICLES

Equipment/Vehicle Type	Fugitive $PM_{2.5}$ (lb/day)
Front End Loader	4.49
Dozer	1.77
Pneumatic Tire Roller	0.89
Vibratory Roller	0.89
Grader	0.01
Backhoe	2.25
Crane	1.00
Concrete Pumper Truck	1.16
Concrete Truck	1.16
Water Tanker	13.39
Dump Truck	11.16
Pick-Up Truck	2.64
Delivery Truck (Medium)	5.44
Delivery Truck (Heavy)	7.44

Alternative One

Equipment requirements were estimated for the construction and demolition activities associated with site preparation for buildings, parking, and trenching for utilities. Tables B-5 to B-7 provide the equipment assumptions and resultant total equipment emissions for Alternative 1. Annual emissions are provided for each year from 2009 through 2011, when all construction would occur.

For both alternatives, dump truck calculations are performed based on the estimated number of total miles needed throughout that year, with a round trip haul of 22 miles. This estimation assumes a 16 ton capacity dump truck. Under total days of operation in the tables, dump trucks will instead display the total annual miles estimated. The major excavation and demolition that has been calculated occurs in 2009, accounting for the large mileage for dump trucks assumed to be hauling away resultant earth and debris.

TABLE B-5: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 1 - 2009

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	6	0.03	0.00	0.00	0.00	0.00	0.02
Front End Loader	184	2.49	0.15	0.13	0.41	0.36	0.64
Chain Saws	11	0.01	0.00	0.00	0.00	0.00	0.01
Excavator	24	0.26	0.02	0.02	0.00	0.05	0.11
Dozer	27	0.29	0.02	0.02	0.02	0.05	0.09
Pneumatic Tire Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Steel Wheel Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paver	0	0.00	0.00	0.00	0.00	0.00	0.00
Vibratory Roller	68	0.08	0.01	0.01	0.03	0.01	0.03
Grader	14	0.08	0.01	0.01	0.00	0.01	0.03
Concrete Pumper Truck	235	2.76	0.22	0.17	0.14	0.31	0.51
Concrete Truck	1259	14.81	1.19	0.93	0.73	1.67	2.75
Crane	1455	6.73	0.66	0.50	0.72	1.27	3.34
Backhoe	94	1.64	0.39	0.24	0.11	0.24	1.86
Water Tanker	0	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	91,081 miles	1.00	0.02	0.01	0.00	0.00	0.15
Pick-Up Truck	887	0.01	0.01	0.00	1.17	0.00	0.11
Delivery Truck (Medium)	930	0.07	0.02	0.00	2.53	0.00	0.05
Delivery Truck (Heavy)	485	0.21	0.02	0.00	1.80	0.00	0.02
Air Compressor	147	0.33	0.03	0.03		0.05	0.13
Total Emissions		**30.80**	**2.78**	**2.06**	**7.67**	**4.04**	**9.86**

TABLE B-6: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 1 - 2010

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	4	0.020	0.002	0.001	0	0.003	0.015
Front End Loader	112	1.512	0.088	0.081	0.25	0.222	0.391
Chain Saws	8	0.007	0.001	0.001	0.00	0.001	0.005
Excavator	8	0.087	0.006	0.005	0.00	0.017	0.036
Dozer	15	0.163	0.012	0.009	0.01	0.030	0.049
Pneumatic Tire Roller	31	0.000	0.000	0.000	0.01	0.000	0.000
Steel Wheel Roller	0	0.000	0.000	0.000	0.00	0.000	0.000
Asphalt Paver	0	0.000	0.000	0.000	0.00	0.000	0.000
Vibratory Roller	11	0.062	0.005	0.004	0.00	0.010	0.021
Grader	9	0.053	0.004	0.003	0.00	0.009	0.018
Concrete Pumper Truck	409	4.81	0.39	0.30	0.24	0.54	0.89
Concrete Truck	2017	23.73	1.91	1.48	1.17	2.67	4.41
Crane	2935	13.57	1.36	1.01	1.46	2.13	6.74
Backhoe	61	0.65	0.05	0.04	0.07	0.12	0.21
Water Tanker	0	0.000	0.000	0.000	0.00	0.000	0.000
Dump Truck	14,457 miles	0.159	0.004	0.002	0.03	0.000	0.024
Pick-Up Truck	1512	0.010	0.011	0.000	2.00	0.000	0.189
Delivery Truck (Medium)	1675	0.118	0.034	0.004	4.56	0.001	0.097
Delivery Truck (Heavy)	1465	0.629	0.069	0.005	5.45	0.000	0.072
Air Compressor	89	0.199	0.018	0.018		0.033	0.079
Total Emissions		**45.78**	**3.96**	**2.97**	**15.26**	**5.79**	**13.26**

TABLE B-7: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 1 - 2011

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	0	0.00	0.00	0.00	0.00	0.00	0.00
Front End Loader	1	0.01	0.00	0.00	0.00	0.00	0.00
Chain Saws	1	0.00	0.00	0.00	0.00	0.00	0.00
Excavator	0	0.00	0.00	0.00	0.00	0.00	0.00
Dozer	1	0.01	0.00	0.00	0.00	0.00	0.00
Pneumatic Tire Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Steel Wheel Roller	1	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paver	3	0.02	0.00	0.00	0.00	0.00	0.01
Vibratory Roller	2	0.01	0.00	0.00	0.00	0.00	0.00
Grader	1	0.01	0.00	0.00	0.00	0.00	0.00
Concrete Pumper Truck	587	6.91	0.56	0.43	0.34	0.78	1.28
Concrete Truck	1297	15.26	1.23	0.95	0.75	1.72	2.84
Crane	2965	13.71	1.37	1.02	1.48	2.15	6.81
Backhoe	0	0.00	0.00	0.00	0.00	0.00	0.00
Water Tanker	0	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	704 miles	0.01	0.00	0.00	0.01	0.00	0.00
Pick-Up Truck	625	0.00	0.00	0.00	0.82	0.00	0.08
Delivery Truck (Medium)	785	0.06	0.02	0.00	2.14	0.00	0.05
Delivery Truck (Heavy)	955	0.41	0.05	0.00	3.55	0.00	0.05
Air Compressor	0	0.00	0.00	0.00		0.00	0.00
Total Emissions		**36.41**	**3.23**	**2.41**	**9.10**	**4.66**	**11.13**

Alternative Two

Under Alternative 2, renovation of building 17 would not occur. There is also less demolition and more new construction. The same SF of total building space would be constructed. Some projects vary from the locations under Alternative One. Equipment requirements were estimated for the construction activities associated with site preparation for buildings, construction of the parking, and trenching for utilities. Construction for Alternative 2 will follow the same timeline shown in

Figure B-1. Alternative 2 emissions are presented in Tables B-8 through B-10.

TABLE B-8: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 2 - 2009

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	6	0.03	0.00	0.00	0.00	0.00	0.02
Front End Loader	136	1.84	0.11	0.10	0.31	0.27	0.47
Chain Saws	12	0.01	0.00	0.00	0.00	0.00	0.01
Excavator	24	0.27	0.02	0.02	0.00	0.05	0.11
Dozer	28	0.30	0.02	0.02	0.02	0.06	0.09
Pneumatic Tire Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Steel Wheel Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paver	0	0.00	0.00	0.00	0.00	0.00	0.00
Vibratory Roller	42	0.08	0.01	0.01	0.02	0.01	0.03
Grader	14	0.08	0.01	0.01	0.00	0.02	0.03
Concrete Pumper Truck	235	2.76	0.22	0.17	0.14	0.31	0.51
Concrete Truck	1259	14.81	1.19	0.93	0.73	1.67	2.75
Crane	1427	6.60	0.66	0.49	0.71	1.14	3.28
Backhoe	72	1.24	0.30	0.18	0.08	0.18	1.41
Water Tanker	0	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	94,438 miles	1.04	0.03	0.02	0.00	0.00	0.16
Pick-Up Truck	887	0.01	0.01	0.00	1.17	0.00	0.11
Delivery Truck (Medium)	930	0.07	0.02	0.00	2.53	0.00	0.05
Delivery Truck (Heavy)	485	0.21	0.02	0.00	1.80	0.00	0.02
Air Compressor	97	0.22	0.02	0.02		0.04	0.09
Total Emissions		**29.57**	**2.63**	**1.95**	**7.51**	**3.75**	**9.15**

TABLE B-9: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 2 - 2010

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	4	0.019	0.002	0.001	0	0.003	0.015
Front End Loader	87	1.169	0.068	0.062	0.20	0.172	0.304
Chain Saws	8	0.007	0.001	0.001	0.00	0.001	0.005
Excavator	8	0.085	0.006	0.005	0.00	0.016	0.036
Dozer	14	0.157	0.012	0.009	0.01	0.029	0.047
Pneumatic Tire Roller	26	0.000	0.000	0.000	0.01	0.000	0.000
Steel Wheel Roller	0	0.000	0.000	0.000	0.00	0.000	0.000
Asphalt Paver	0	0.000	0.000	0.000	0.00	0.000	0.000
Vibratory Roller	10	0.061	0.005	0.004	0.00	0.010	0.020
Grader	8	0.051	0.004	0.003	0.00	0.009	0.017
Concrete Pumper Truck	409	4.81	0.39	0.30	0.24	0.54	0.89
Concrete Truck	2017	23.73	1.91	1.48	1.17	2.67	4.41
Crane	2690	12.44	1.24	0.93	1.34	1.95	6.18
Backhoe	42	0.44	0.03	0.03	0.05	0.08	0.15
Water Tanker	0	0.000	0.000	0.000	0.00	0.000	0.000
Dump Truck	13,982 miles	0.154	0.004	0.002	0.00	0.000	0.024
Pick-Up Truck	1512	0.010	0.011	0.000	2.00	0.000	0.189
Delivery Truck (Medium)	1495	0.106	0.030	0.004	4.07	0.001	0.087
Delivery Truck (Heavy)	1285	0.551	0.061	0.004	4.78	0.000	0.063
Air Compressor	65	0.145	0.013	0.013		0.024	0.057
Total Emissions		**43.93**	**3.79**	**2.85**	**13.86**	**5.51**	**12.50**

TABLE B-10: ANNUAL EQUIPMENT EMISSIONS FOR CONSTRUCTION, ALTERNATIVE 2 - 2011

Construction Vehicle Type	Total Days of Operation	Annual Emissions (TPY)					
		NO_x	VOC	Exhaust $PM_{2.5}$	Fugitive $PM_{2.5}$	SO_2	CO
Chipping Machine	0	0.00	0.00	0.00	0.00	0.00	0.00
Front End Loader	1	0.01	0.00	0.00	0.00	0.00	0.00
Chain Saws	1	0.00	0.00	0.00	0.00	0.00	0.00
Excavator	0	0.00	0.00	0.00	0.00	0.00	0.00
Dozer	1	0.01	0.00	0.00	0.00	0.00	0.00
Pneumatic Tire Roller	0	0.00	0.00	0.00	0.00	0.00	0.00
Steel Wheel Roller	1	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Paver	3	0.02	0.00	0.00	0.00	0.00	0.01
Vibratory Roller	2	0.01	0.00	0.00	0.00	0.00	0.00
Grader	1	0.01	0.00	0.00	0.00	0.00	0.00
Concrete Pumper Truck	550	6.47	0.52	0.40	0.32	0.73	1.20
Concrete Truck	1150	13.53	1.09	0.85	0.67	1.52	2.52
Crane	2660	12.30	1.23	0.91	1.33	1.93	6.11
Backhoe	0	0.00	0.00	0.00	0.00	0.00	0.00
Water Tanker	0	0.00	0.00	0.00	0.00	0.00	0.00
Dump Truck	13,395 miles	0.01	0.00	0.00	0.01	0.00	0.00
Pick-Up Truck	625	0.00	0.00	0.00	0.82	0.00	0.08
Delivery Truck (Medium)	465	0.03	0.01	0.00	1.27	0.00	0.03
Delivery Truck (Heavy)	955	0.41	0.05	0.00	3.55	0.00	0.05
Air Compressor	0	0.00	0.00	0.00		0.00	0.00
Total Emissions		**32.81**	**2.90**	**2.17**	**7.97**	**4.19**	**10.01**

5.1.2 Emissions from Painting Activities

For painting building structures, it was assumed that water-based latex paint would be used with a VOCs content of one pound per gallon and one gallon of paint covers approximately 300 square feet. Annual painting emissions would be the same for both alternatives. Three coats of paint will be applied (one primer and two finish) to approximately 3,612,000 square feet of interior surfaces in 2010 and 1,344,000 SF in 2011. There would be no painting activities in 2009. These values assume a mixture of types of interior space that result in an overall average ratio of walls needing paint to floor space of 3 to 1. Based on these assumptions, approximately 36,120 gallons of paint are needed for 2010 interior construction and 13,440 gallons are needed for interior construction in 2011. Total interior painting for buildings constructed over the course of each year of construction creates approximate VOCs emissions of:

- 2010 = 18.06 tons
- 2011 = 6.72 tons

Emissions from painting parking spaces were based on four-inch wide stripes. It was assumed that the average parking space is 9 feet wide by 19 feet long and every two parking spaces share a common line. Approximately 10 square feet would be painted for every parking space. For parking spaces, it was assumed that alkyd paint would be used with a VOCs content of three pounds per gallon and one gallon of paint covers approximately 200 square feet. One coat of paint would be applied to the parking surfaces. Based on the construction of 1,900 spaces to be painted in 2010 and 600 additional spaces in 2011, approximate VOCs emissions for painting parking spaces would be:

- 1,900 spaces, 2010 = 0.14 tons
- 600 spaces, 2011 = 0.05 tons

5.1.5 Summary of Construction Emissions

After emissions analysis was performed for all aspects of construction, the totals were added to determine the combined annual construction emissions. Tables B-11 through B-16 summarize the results for each year of both alternatives. Total construction emissions for each year of Alternative 1 are provided in Tables B-11 through B-13 and total annual construction emissions for Alternative 2 are provided in Tables B-14 through B-16.

TABLE B-11: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 1 - 2009

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	30.80	2.78	2.06	4.04	9.86
Fugitive Emissions	NA	NA	7.67	NA	NA
Painting	NA	0.00	NA	NA	NA
Total Emissions from Construction	**30.80**	**2.78**	**9.73**	**4.04**	**9.86**

TABLE B-12: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 1 - 2010

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	45.78	3.96	2.97	5.79	13.26
Fugitive Emissions	NA	NA	15.26	NA	NA
Painting	NA	18.20	NA	NA	NA
Total Emissions from Construction	**45.78**	**22.16**	**18.23**	**5.79**	**13.26**

TABLE B-13: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 1 - 2011

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	36.41	3.23	2.41	4.66	11.13
Fugitive Emissions	NA	NA	9.10	NA	NA
Painting	NA	6.77	NA	NA	NA
Total Emissions from Construction	**36.41**	**10.00**	**11.51**	**4.66**	**11.13**

TABLE B-14: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 2 - 2009

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	29.57	2.63	1.95	3.75	9.15
Fugitive Emissions	NA	NA	7.51	NA	NA
Painting	NA	0.00	NA	NA	NA
Total Emissions from Construction	**29.57**	**2.63**	**9.46**	**3.75**	**9.15**

TABLE B-15: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 2 - 2010

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	43.93	3.79	2.85	5.51	12.50
Fugitive Emissions	NA	NA	13.86	NA	NA
Painting	NA	18.20	NA	NA	NA
Total Emissions from Construction	**43.93**	**21.99**	**16.71**	**5.51**	**12.50**

TABLE B-16: EMISSIONS FROM CONSTRUCTION, ALTERNATIVE 2 - 2011

Construction Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Use of Heavy Equipment	32.81	2.90	2.17	4.19	10.10
Fugitive Emissions	NA	NA	7.97	NA	NA
Painting	NA	6.77	NA	NA	NA
Total Emissions from Construction	**32.81**	**9.67**	**10.14**	**4.19**	**10.01**

5.2 Operations Emissions

Operations emissions are from heating sources and generators. There are no new commuters assumed because all new employees are relocating from Walter Reed Army Medical Center, 6 miles away in the same AQCR, and do not add new commuter emissions to the AQCR.

5.2.1 Heating Source Emissions

Designs for the proposed facilities have not yet been prepared; therefore, actual boiler or furnace types and sizes have not been determined. Operational heating requirements for the EIS analysis are based on the most recent Commercial Buildings Energy Consumption Survey (CBECS) in 2003 conducted by the Department of Energy, Energy Information Administration (DOI, 2003). Table C30 from this document indicates that the average energy intensity for office buildings using natural gas in climate zone 3, which includes Maryland, is 30.1 cubic feet (CF) of gas annually per square foot (SF) of floor space. Table C30 also provides estimates for medical facilities to consume 99.9 CF/SF per year. The same table, using proportions for the natural gas estimates given for lodging structures, indicates that the average energy intensity for a residence is 37.5 cubic feet of gas per SF annually. At 1,000 British Thermal Units (BTUs) per CF of gas, this equates annually to 30,100, 99,900, and 37,500 BTU annually per SF of office, medical, and residential space respectively. Natural gas is provided by the local utility to the vicinity of the proposed development areas. However, at NNMC most large buildings will be heated by a central heating plant that is expected to supply steam to the proposed structures, with the following exception. The Bachelors Enlisted Quarters (BEQ) is expected to have its own natural gas boiler and will not be heated by the central heating plant. Water heating is assumed to either be provided electrically or to be included in the energy intensities from the CBECS. Both alternatives contain the same number of SF per building and therefore heating estimates are the same for both. Inpatient/Outpatient Medical Facilities, administrative space, and the TBI/PTSD Center would become operational in 2011. The BEQ, WTU Dining Facility, Fitness Center, and Fisher Houses would come online in 2012, when all BRAC projects would be fully operational.

Space and water heating for 200,000 SF of administrative space and 50,000 SF for the TBI/PTSD Center (assume TBI/PTSD Center heating is similar to administrative space), and 638,000 SF of medical space requires annually:

- (250,000 SF)(30.1 CF/SF) + (638,000 SF)(99.9 CF/SF) = 71.26 million CF natural gas

In 2012, with the addition of 278,000 SF of residential space and 64,000 SF of Fitness Center space (assume fitness center heating is similar to administrative space), space and water heating, for all new BRAC construction at full operation is:

- (314,000 SF)(30.1 CF/SF) + (638,000 SF)(99.9 CF/SF) + (278,000)(37.5 CF/SF) = 83.6 million CF natural gas

The BEQ to be constructed on NNMC is assumed to be heated by a small boiler that operates at less than 100 million Btu per hour. Operational heating emissions are based on the USEPA's *AP-42 Fifth Edition, Compilation of Air Pollution Emission Factors Volume I, Chapter 1: Stationary Sources, Supplement D* (EPA, 1998).

The following natural gas emission rates are assumed:

- NO_x = 100 lb NO_x /10^6 CF natural gas
- VOCs = 5.5 lb/10^6 CF natural gas
- $PM_{2.5}$ = 7.6 lb/10^6 CF natural gas
- SO_2 = 0.6 lb/10^6 CF natural gas
- CO = 84 lb/10^6 CF natural gas

The currently operating central heating plant produces emissions similar to those expected from the BEQ boiler. The Title V permit for the central heating plant boilers restricts the boilers to a 36 lb/10^6 CF of natural gas emission rate, significantly less than the 100 lb/10^6 CF natural gas assumed by the AP-42 manual. For all new buildings that will be fueled by the central heating plant, this emissions rate has been used in calculations.

For Alternative Two, which has 85,000 SF more of newly constructed administration space and 85,000 SF less renovated space in Building 17, it is assumed that net heating requirements and resultant emissions from heating are approximately the same.

The resultant annual emissions for 2011 and 2012 are available in Table B-17.

TABLE B-17: TOTAL ANNUAL EMISSIONS FROM HEATING – ALTERNATIVES 1 & 2

Heating	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
2011	1.283	0.196	0.271	0.021	2.993
2012 (Full Operation)	1.800	0.230	0.318	0.025	3.512

5.2.2 Generators

For the backup generators, which are only required for the medical facility, the final rule regarding emissions from Nonroad Diesel Engines provides the assumed emission rates NO_x, VOC, and $PM_{2.5}$ (40 CFR Parts 9, 69, et al, Control of Emissions of Air Pollution From Nonroad

Diesel Engines and Fuel; Final Rule. Federal Register, Tuesday, June 29, 2004). This rule requires generators over 750 brake-horsepower (bhp) to meet the following Tier 4 standards beginning in 2011:

- NOx = 2.6 g/bhp-hr
- PM = .075 g/bhp-hr (all assumed to be $PM_{2.5}$)
- SO_2 = 0.741 g/bhp-hr
- NMHC = 0.3 g/bhp-hr.
- CO = 5.595 g/bhp-hr

The conversion of NMHC to VOCs utilizes the following equation: VOC=1.053xTHC, THC=NMHC/.984; therefore:

- VOCs = (1.053/.984)(NMHC)=0.321 g/bhp-hr

Two 750 hp generators will be included in the operations. Using an assumption of 1,000 annual hours, the annual emissions of NO_x, VOC, $PM_{2.5}$, CO, and SO_2 were calculated as shown in Table B-18. Both generators will come online in 2011.

TABLE B-18: TOTAL ANNUAL EMISSIONS FROM GENERATORS, ALTERNATIVES 1 AND 2

Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
Two 750 hp generators, 500 annual hours each	2.88	0.356	0.08	0.82	6.20

5.2.3 Permits

For permitting purposes, generators over 500 bhp and boilers are analyzed by their overall potential to emit emissions. The potential to emit for generators is the permitted limit, assumed to be 500 hours for which the emissions were calculated in the preceding section. The potential to emit for the heating source is based on the capacity of the heating source operated for the full year, or 8,760 hours.

Designs have not yet been completed for heating requirements; however, the central plant, which has four boilers each with 67 million BTU/hour capacity and a chiller with 12 million BTU/hour capacity, only used 47,585 million BTUs of natural gas from June 2006 to May 2007. It is operating well below capacity. If additional boilers are added to provide a safety factor in the event of boiler breakdown or repair, the Title V operating permit would need to be modified; however, the current boiler emissions per boiler are well below permitted limits and additional boiler capacity is unlikely to be a serious issue. Given the current annual emissions, it is expected that under Alternative One, NNMC would continue to emit under 50 TPY NO_x, as is required by the Title V permit. New generators, which are anticipated for the new medical care facility, and the individual boiler for the BEQ, will require a modification to the permit.

The BEQ is expected to require an individual boiler and would not need to be included under NNMC's Title V permit if the BEQ is built as a public-private venture because the boiler would be under separate ownership and operation. The boiler size has not yet been designed, so to estimate the PTE, the calculation below was used.

The heating sources evaluated in the preceding section are assumed to produce the projected annual emissions by operating on average of 66.7-percent capacity for a total of 1000 hours each year. For the BEQ, to convert the emissions to those at 100-percent capacity for a full year, the emissions are multiplied by the conversion shown below:

Full year Potential to Emit = (estimated annual emissions) x (8760 hours per year/1,000 hours of actual operation) x (1/.67).

Therefore:

- (246,000 SF) x (37.5 SCF/SF/Year) x (100 lb/10^6 NO_x SCF)/(2000 tons/lb) = 0.4612 TPY NO_x emissions from the BEQ
- (0.4612 TPY NO_x) x (8,760 hours annual/(1,000 hours actual x .67) = 6.031 TPY NO_x

The resulting PTE emissions are:

- 6.03 TPY NO_x
- 0.332 TPY VOC
- 0.458 TPY $PM_{2.5}$
- 0.036 TPY SO_2
- 5.066 TPY CO

5.2.4 Summary of Annual Operations Emissions

Annual operations emissions include emissions from heating the building space and water and generator emissions. All incoming personnel will be coming from within the ACQR 47 airshed, and therefore commuter emissions are not included. Tables B-19 and B-20 provide the total annual operations emissions.

TABLE B-19: ANNUAL EMISSIONS FROM OPERATIONS, ALTERNATIVES 1 & 2 - 2011

Operations Activity	Total Annual Emissions (TPY)				
	NOx	VOC	$PM_{2.5}$	SO_2	CO
Heating	1.283	0.196	0.271	0.021	2.993
Generators	2.883	0.354	0.083	0.822	6.203
Total Emissions from Operations	**4.165**	**0.552**	**0.356**	**0.843**	**9.196**

TABLE B-20: ANNUAL OPERATIONS EMISSIONS, ALTERNATIVES 1 & 2 – 2012 (FULL OPERATION)

Operations Activity	Total Annual Emissions (TPY)				
	NOx	VOC	$PM_{2.5}$	SO_2	CO
Heating	1.800	0.230	0.318	0.025	3.512
Generators	2.883	0.354	0.083	0.822	6.203
Total Emissions from Operations	**4.683**	**0.586**	**0.356**	**0.847**	**9.715**

5.3 Combined Construction and Operations Emissions

Each year's emissions were summed by combining the total emissions for construction and operations to determine whether emissions in any year exceed the *de minimis* values. The emissions for years evaluated are displayed in Tables B-21 and B-22, with the *de minimis* values shown at the top of each column for comparison. Operational emissions overlap with construction emissions during 2011 only.

Tables B-21, and B-22 show that emissions associated with constructing and operating the alternatives, when compared to the *de minimis* values for an area that is in moderate nonattainment for ozone, nonattainment for $PM_{2.5}$, and maintenance for CO, fall below the *de minimis* values for NO_x, VOC, $PM_{2.5}$, SO_2, and CO.

TABLE B-21: TOTAL ANNUAL EMISSIONS, ALTERNATIVE 1

Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
***de minimis* levels**	**100**	**50**	**100**	**100**	**100**
2009 - Construction	30.80	2.78	9.73	4.04	9.86
2010 – Construction	45.78	22.16	18.23	5.79	13.26
2011 – Construction and Operations	40.58	10.55	11.86	5.50	20.33
2012 – Full Operation	**4.165**	**0.552**	**0.356**	**0.847**	**9.715**

TABLE B-22: TOTAL ANNUAL EMISSIONS, ALTERNATIVE 2

Activity	Total Annual Emissions (TPY)				
	NO_x	VOC	$PM_{2.5}$	SO_2	CO
***de minimis* levels**	**100**	**50**	**100**	**100**	**100**
2009 - Construction	29.57	2.63	9.46	3.75	9.15
2010 - Construction	43.93	21.99	16.71	5.51	12.50
2011 – Construction and Operations	37.49	10.26	10.54	5.03	19.21
2012 – Full Operation	**4.683**	**0.586**	**0.356**	**0.847**	**9.715**

Therefore, a full conformity determination is not required for Alternatives One or Two. A draft Record of Non-Applicability (RONA) can be found in Attachment One of this appendix.

5.4 Regional Significance

Air emissions were also evaluated to determine regional significance. The *Plan to Improve Air Quality in the Washington, DC-MD-VA Region: State Implementation Plan (SIP), "Severe Area SIP" Demonstrating Rate of Progress for 2002 and 2005; Revision to 1990 Base Year Emissions; and Severe Area Attainment Demonstration for the Washington DC-MD-VA Nonattainment Area* (MWCOG, 2004) sets forth daily target levels of 16 tons per day (TPD) of VOCs and 109 tons per day of NO_x for point sources within the Washington Metropolitan ozone nonattainment region. Additionally, daily target levels of 82 TPD NO_x and 68 TPD VOCs were set for nonroad sources and 234 TPD NO_x and 97 TPD VOCs for mobile or on-road sources. Although the 8-hour ozone standard has been approved for use instead of the 1-hour ozone standard, the 8-hour SIP has not yet been finalized. Therefore, pursuant to USEPA regulations and in accordance with the Metropolitan Washington Air Quality Committee, the 1-hour SIP remains valid as a basis for comparison of emissions. A draft 8-Hour SIP, while not yet approved, has been written and prescribes emissions budgets for 2008 for point, nonroad, and on-road sources (MWAQC, 2007). The 8-Hour ozone SIP for AQCR 47 was written by the Metropolitan Washington Council of Governments and no final approval date has been made available.

Table B-23 presents daily target levels.

TABLE B-23: REGIONAL EMISSIONS INVENTORY - SIP

Source of Emissions	1-Hour Attainment Year (2005) (Tons Per Day)		8-Hour Rate-of-Progress Year (2008) (Tons Per Day)	
	NO_x	VOC	NO_x	VOC
Point	109	16	229	14
Non-Road	82	68	77	92
On-Road	234	97	160	71
Source: MWCOG, 2007				

Additionally, there is no SIP in place for the newly promulgated $PM_{2.5}$ regulations. The DC-MD-VA region has three years to implement a SIP that will create a regional emission inventory for the pollutant $PM_{2.5}$ (EPA, 2006).

The increase in annual emissions from the construction activities would not make up ten-percent or more of the available regional emission inventory for VOCs or NO_x and would not be regionally significant. Air quality impacts are therefore not considered to be significant.

6.0 Mobile Sources Air Quality Impacts

This section assesses ambient air quality impacts resulting from mobile sources related to the proposed project activities.

This analysis follows 40 CFR 93.123(b)(1) (March 10, 2006), and a Memorandum of Reflecting the Revised $PM_{2.5}$ NAAQS in NEPA Evaluations, (June 25, 2007, Office of Enforcement and Compliance, USEPA), and Revision to Maryland's Transportation Conformity state Implementation Plan, (November 9, 2006, MDE). In light of the current state of the ambient air quality in the study area and project activities relevant to mobile sources, the two pollutants: CO and O_3 are of prime concerns. $PM_{2.5}$ is not a concern for the proposed project because the project does not and will not have 8 percent or more projected traffic volumes comprised of diesel trucks as defined by MDE per USEPA's recommendation. The mobile sources impact analysis methodologies are described below.

6.1 Mobile Sources Analysis Methodologies

Ambient mobile sources impact concentrations resulting from the proposed action are associated mainly with on-road roadway sources and vehicular movements in the proposed parking facilities. The most direct effects on air quality relevant to the proposed project would come from CO, due to the fact that ambient concentrations of CO are predominantly influenced by roadway and garage mobile source emissions. Carbon monoxide is a colorless and odorless gas that results from the incomplete combustion of gasoline and other fossil fuels. Elevated concentrations are usually limited to locations near intersections and along congested roadways. It is important to evaluate CO impact concentrations on a micro-scale (close to the source) basis.

The USEPA analysis tools were utilized for the NNMC mobile sources air quality analysis, including MOBILE6.2 for emission factors estimates; CAL3QHC for on-road mobile sources impact analysis; and SCREEN3 for garage impact analysis.

The emission estimates for CO and ozone precursors - NOx and VOCs resulting from the proposed project were estimated by using specified conditions and regional assumptions for Montgomery County as described in the MDE SIP MOBILE6 inventories and documents for calculating emissions.

The methodology for predicting motor vehicle-generated pollutant concentrations (CO, NO_x, and VOCs) is characterized by examination of meteorology, traffic conditions, and physical configurations. Except for survey or estimated data obtained from traffic analysis, other assumptions or traffic information for the study areas used in the emissions analysis were based on Maryland Department of Transportation (MDOT), and MWCOG Transportation prepared FY 2006–2011 Transportation Improvement Program (TIP) / SIP Conformity Analysis.

6.1.1 Emission Evaluation

Vehicular emissions of CO, NO_X, and VOCs pollutants were first determined mathematically as a function of route speed, vehicle classification, ambient temperature, and other factors. A dispersion model was then employed to simulate mathematically how traffic, meteorology, and geometry combine to affect pollutant concentrations.

Emission factors were calculated by utilizing the USEPA's computerized mobile source emissions model MOBILE6.2 for estimating the composite vehicular emission factors. Following regional recommendations described in the MDE SIP and MWCOG TIP/SIP conformity analysis report, including most recent registration distributions (2005); diesel sales fractions; inspection and maintenance programs of Idle, IM240, OBD, and evaporation programs; Anti-Tampering programs; VMT mix; and gasoline RVP, etc., were used in emission factors determination. The traffic volumes and vehicle travel lengths on affected roadways were then multiplied by emission factors to obtain emission strengths under various project scenarios.

6.1.2 Microscale CO Impact Analysis

To evaluate the air quality microscale impacts resulting from vehicular emissions on the roadways, a mathematical model CAL3QHC (Version 2.0, EPA-404/12-92-006) developed by the USEPA was used to calculate the predicted air constituent concentrations. CAL3QHC is a state-of-the-art dispersion model widely used for predicting pollutant concentrations near roadway segments and intersections. This model assumes that the dispersion of pollutants downwind of a source follow a Gaussian distribution. Each lane of traffic is modeled as a straight, continuous, finite line source with a uniform emission rate. The downwind CO concentrations can be calculated by numerical integration along the line source.

Analysis Sites

The 1-hour and 8-hour CO impacts of mobile sources were analyzed at five (5) major intersections:

- Rockville Pike (MD 355) & Cedar Lane / North Drive
- Rockville Pike (MD 355) & Wilson Drive/ North Wood Road
- Rockville Pike (MD 355) & South Drive / South Wood Road
- Rockville Pike (MD 355) & Jones Bridge
- Connecticut Ave (MD 185) & Jones Bridge Road

These intersections are adjacent to the development sites and would receive the highest impacts from the proposed projects. The receptor locations within NNMC campus near North Wood Road and South Wood Road were also placed. The receptor locations for each micro-scale analysis site were placed on the intersection corners and mid-block locations along the sidewalks where the general public has continuous access. These receptors were selected because they are the locations where the traffic analysis indicated that the greatest air impacts and maximum changes in the air pollutant concentrations could be expected.

Forty receptors for each of the analyzed intersections were selected for CO micro-scale air quality analysis. All receptors were placed at 1.8 meters above the ground. All corners of the analyzed intersection, and the mid-block locations were included in the modeling to ensure that the worst-case concentrations were calculated. The air pollutant concentrations were predicted for peak-hour traffic periods for existing, both future build and future no-build analysis scenarios.

Meteorological Conditions

The principal meteorological factors that influence the transport and concentration of pollutants from vehicular sources are wind speed, wind direction, and temperatures. Generally, low wind speeds limit the dispersion of emitted pollutants from roadway sources and increase downwind concentrations. Based on the USEPA guidance, the CO analysis was performed by using a worst-case wind speed of one meter per second. In applying the CAL3QHC dispersion model, the wind angle was varied at five-degree intervals to determine the worst-case wind direction resulting in the maximum concentrations at each analysis site. A conservative assumption of a persistence of wind for 8-hour period was used.

Traffic Data

Traffic data used for air quality analysis were derived from the EIS/Master Plan traffic survey and from MDOT documents. The major elements of traffic data used in air analysis are traffic volumes and turning movements, vehicle classifications, traffic speeds, number of lanes, signal timings, the parking facilities plans and ins/outs volumes. The peak traffic periods were subjected to full-scale micro-scale analysis.

Background Concentrations

Background concentrations are those CO levels not directly accounted for through the mobile source modeling analysis. These background levels must be added to the modeling results to obtain total pollutant concentrations. Background values used in the air quality analysis were based on the methodology described USEPA guidance. Since the Montgomery County does not have a monitoring station, the most recent 3 years (2004-2006) CO monitoring data in nearby regions were reviewed. The worst-case 2nd high 1-hour (4.0 ppm) and 8-hour (3.4 ppm) monitored levels among these 3 years were used as background values for this ambient air analysis.

Parking Garage Emission and Impact Analysis

The major concerns of the parking facilities are the North Parking Garage for patients and South Parking Garage for staff. Unlike other parking areas, which are ground-level open lots that can directly ventilate to the air; these two multi-level structures can accumulate vehicular emissions inside the garages due to vehicle idling and traveling indoors. Both North and South garages are planned to be 7-story structures with 954 and 957 parking spaces, respectively. The emissions associated with the third additional parking garage, smaller with fewer parking spaces, would be less than North and South Parking and therefore the analysis is not provided in detail.

The CO emissions and impacts resulting from the proposed North and South Parking Garages were examined by utilizing MOBILE6.2 emission calculation and impact modeling SCREEN3 procedure and dispersion formula as developed by USEPA. Similar to the roadway emission determination, air emissions and impacts from a multilevel parking garage were calculated first by using the most up-to-date available MOBILE6.2 program, and the impacts were evaluated by using USEPA's dispersion estimates in SCREEN3 model. This analysis assumed that all departing cold autos would idle for one minute before traveling to the exits, and all arriving and departing autos would travel at 5 mph within the parking garage. The worst-case hourly parking activities with highest emissions in North Parking Garage would be 140 vehicles departing from and 70 vehicles arriving to the garage during PM peak-hour. The worst-case hourly parking activities with highest emissions in South Parking Garage would be 150 vehicles departing from and 50 vehicles arriving to the garage, also during PM peak-hour. The highest hourly CO emissions were calculated for these activities. The indoor CO impact concentrations within the parking facility and off-site impacts were estimated by using USEPA's SCREEN3 dispersion formula.

6.2 Mobile Sources Analysis Results

Following the methodologies described above, the existing and future mobile sources air quality impacts of the proposed project and their environmental consequences were evaluated and are outlined below.

6.2.1 Parking Garages Impacts

Impacts of air pollutants associated with the proposed North and South Parking Garages were evaluated by utilizing the analysis procedures described above for a parking garage. The parking garage emission and impact calculation were based on the MOBILE6.2 emission factors calculation program, and USEPA's dispersion formula as formatted in SCREEN3 model, as an area source for these naturally ventilated multilevel facilities.

The maximum hourly emissions generated by vehicular parking activities would include CO pollutants released from vehicles idling for departure, traveling in the garage for departing or arriving, and excess traveling between floors. These emissions were estimated for all 7 levels of parking garages. By using emission strengths identified, the indoor CO concentrations were calculated respectively for air quality levels.

In summary, the predicted worst peak-hour CO emission rates and 1-hour CO concentrations within the North and South Parking Garages are respectively presented in Table B-24, and Table B-25 below. Tables B-24A and B-25A present the 8-hour CO concentrations. The predicted maximum CO indoor concentrations on each floor of the two garages are below the NAAQS of 35 ppm, and will be within an MWCOG preferred 25 ppm level at maximum hourly vehicular operation in the garage. The average 8-hour CO concentrations in the North and South garages are also estimated as 6.60 ppm and 6.83 ppm, respectively; and are below the NAAQS of 9 ppm. Therefore, the indoor CO concentrations are not significant.

TABLE B-24: MAXIMUM HOURLY EMISSIONS AND INDOOR CO CONCENTRATIONS – NORTH PARKING GARAGE

Floor	Emissions Generated on This Floor	Emissions From Excess Vehicles (Traveling Between Floors)	Total Maximum Hourly CO Emissions	Predicted Maximum Hourly Indoor CO Concentrations*
	(g/hour)	(g/hour)	(g/hour)	(ppm**)
1st	57.01	59.67	116.68	10.22
2nd	57.01	49.73	106.74	9.69
3rd	57.01	39.78	96.79	9.16
4th	57.01	29.84	86.85	8.63
5th	57.01	19.90	76.91	8.10
6th	57.01	9,95	66.96	7.57
7th	57.01	0	57.01	7.04
All	**399.07**	**208.87**	**607.94**	**8.63**

* Including 1-hour CO background concentration 4.0 ppm
** ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

TABLE B-24A: MAXIMUM EIGHT-HOUR AVERAGE EMISSIONS AND INDOOR CO CONCENTRATIONS – NORTH PARKING GARAGE

Floor	Emission Generated on This Floor (8-Hour Average)	Emission From Excess Vehicles (Traveling Between Floors, 8-Hour Average)	Total Maximum Eight-Hour Average CO Emissions	Predicted Maximum Eight-Hour Average Indoor CO Concentrations*
	(g/hour)	(g/hour)	(g/hour)	(ppm**)
1st	39.91	41.77	81.68	7.75
2nd	39.91	34.81	74.72	7.38
3rd	39.91	27.85	67.75	7.01
4th	39.91	20.89	60.80	6.64
5th	39.91	13.93	53.84	6.27
6th	39.91	6.97	46.87	5.90
7th	39.91	0	39.91	5.53
All	**279.35**	**146.21**	**425.56**	**6.60**

* Including 8-hour CO background concentration 3.4 ppm
** ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

TABLE B-25: MAXIMUM HOURLY EMISSIONS AND INDOOR CO CONCENTRATIONS – SOUTH PARKING GARAGE

Floor	Emissions Generated on This Floor	Emissions From Excess Vehicles (Traveling Between Floors)	Total Maximum Hourly CO Emissions	Predicted Maximum Hourly Indoor CO Concentrations*
	(g/hour)	(g/hour)	(g/hour)	(ppm**)
1st	59.95	63.02	122.97	10.56
2nd	59.95	52.94	112.89	10.02
3rd	59.95	42.87	102.82	9.48
4th	59.95	32.79	92.74	8.94
5th	59.95	22.71	82.66	8.41
6th	59.95	12.63	72.58	7.87
7th	59.95	0	59.95	7.03
All	**419.65**	**226.96**	**646.61**	**8.90**

* Including 1-hour CO background concentration 4.0 ppm
** ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

TABLE B-25A: MAXIMUM EIGHT-HOUR AVERAGE EMISSIONS AND INDOOR CO CONCENTRATIONS – SOUTH PARKING GARAGE

Floor	Emission Generated on This Floor (8-Hour Average)	Emission From Excess Vehicles (Traveling Between Floors, 8-Hour Average)	Total Maximum Eight-Hour Average CO Emissions	Predicted Maximum Eight-Hour Average Indoor CO Concentrations*
	(g/hour)	(g/hour)	(g/hour)	(ppm**)
1st	41.97	44.11	86.08	7.99
2nd	41.97	37.06	79.02	7.61
3rd	41.97	30.01	71.97	7.24
4th	41.97	22.95	64.92	6.86
5th	41.97	15.90	57.86	6.49
6th	41.97	8.84	50.81	6.11
7th	41.97	0	41.97	5.52
All	**293.76**	**158.87**	**452.63**	**6.83**

*: Including 8-hour CO background concentration 3.4 ppm
**: ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

By using USEPA's dispersion formula established in SCREEN3 model, the outdoor CO impact concentrations resulting from the garages at the nearby receptors and intersections were calculated. By using SCREEN3 model for area sources, the CO impact concentrations resulting from all seven floors of the North and South garages generated pollutants were estimated at the nearest public access areas and intersections. The maximum impacts at the worst-case receptor of these sites are presented in Table B-26. As shown in the table, the predicted maximum total hourly impacts of parking garages are 0.17 ppm and 0.14 ppm, respectively at the garage entrance and the closest roadway intersection; while the predicted total 8-hourly impacts of parking garages are 0.12 ppm and 0.10 ppm, respectively at the garage entrance and the closest roadway intersection.

TABLE B-26: MAXIMUM OUTDOOR CO IMPACT CONCENTRATIONS – FROM NORTH AND SOUTH PARKING GARAGES

Site	Maximum 1-hour CO Outdoor Impact Concentration Resulting From North Garage	Maximum 1-hour CO Outdoor Impact Concentration Resulting From South Garage	Total Maximum 1-Hour CO Outdoor Impact	Total Maximum 8-Hour CO Outdoor Impact
	(ppm*)	(ppm)	(ppm)	(ppm)
Site near North Garage Entrance	0.091	0.082	0.174	0.122
Site near South Garage Entrance	0.096	0.077	0.173	0.121
Closest Roadway Inter-section	0.069	0.073	0.142	0.099

*: ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

These impacts were added to the impacts of roadway vehicular emissions to obtain the total microscale impacts from the project under the build scenarios, as described in Section 6.2.2.

6.2.2 Mobile Source Microscale Impacts

Vehicular emissions on the roadway system were determined mathematically as a function of route speed, vehicle classification, ambient temperature and other factors. A dispersion model was then employed to simulate mathematically how traffic, meteorology and geometry combine to affect pollutant concentrations. The one-hour and eight-hour CO concentrations resulting from vehicular emissions on highways and streets near each site were calculated for the existing, future build, and no-build scenarios. The CO predictions were performed for the peak hours under the worst-case traffic conditions. The impacts resulting from the roadway emissions and garage pollutants were added to the background concentrations to predict total CO pollutant concentrations. The impacts of the parking garage on the analyzed intersection(s) were also included in the total CO concentration calculation under the future build condition. The total one-hour and eight-hour CO levels were then compared to their respective NAAQS thresholds of 35 ppm and 9 ppm.

Existing CO Concentrations

The maximum one-hour and eight-hour CO concentrations predicted for existing conditions analysis scenarios are summarized in Table B-27. All estimated concentrations for this scenario are well below the standards, and thus no violations were predicted for one-hour or eight-hour NAAQS at any sites. The estimated existing maximum one- and eight-hour total ambient CO concentrations at the worst-case receptor location among all intersection sites, are 8.8 ppm and 6.80 ppm, respectively.

TABLE B-27: PREDICTED AMBIENT TOTAL CO CONCENTRATIONS - EXISTING CONDITION

Site	Total Ambient 1-hour Concentration*	1-hr CO NAAQS	Total Ambient 8-hour Concentration**	8-hr CO NAAQS
	(ppm***)	(ppm)	(ppm)	(ppm)
Rockville Pike (MD 355) & Cedar Lane/North Drive	8.8	35	6.8	9
Rockville Pike (MD 355) & Wilson Drive/ North Wood Road	7.9	35	6.1	9
Rockville Pike (MD 355) & South Drive / South Wood Road	6.7	35	5.3	9
Rockville Pike (MD 355) & Jones Bridge	8.2	35	6.3	9
Connecticut Ave (MD 185) & Jones Bridge Road	6.7	35	5.3	9

*: Including 1-hour background 4.0 ppm
**: Including 8-hour background 3.4 ppm
***: ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

Future No-Build CO Concentrations

The predicted one-hour and total ambient maximum one-hour and eight-hour CO concentrations for future no-build conditions analysis scenarios are summarized in Table B-28.

TABLE B-28: PREDICTED AMBIENT TOTAL CO CONCENTRATIONS - FUTURE NO-BUILD CONDITION

Site	Total Ambient 1-hour Concentration*	1-hr CO NAAQS	Total Ambient 8-hour Concentration**	8-hr CO NAAQS
	(ppm***)	(ppm)	(ppm)	(ppm)
Rockville Pike (MD 355) & Cedar Lane / North Drive	8.3	35	6.4	9
Rockville Pike (MD 355) & Wilson Drive/ North Wood Road	7.3	35	5.7	9
Rockville Pike (MD 355) & South Drive / South Wood Road	6.3	35	5.0	9
Rockville Pike (MD 355) & Jones Bridge	8.0	35	6.2	9
Connecticut Ave (MD 185) & Jones Bridge Road	6.2	35	4.9	9

*: Including 1-hour background 4.0 ppm
**: Including 8-hour background 3.4 ppm
***: ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

All estimated concentrations for this scenario are well below the standards, and thus no violations were predicted of one-hour or eight-hour NAAQS at any sites. The estimated existing maximum one- and eight-hour total ambient CO concentrations at the worst-case receptor location among all intersection sites, are 8.3 ppm and 6.4 ppm, respectively. All ambient concentrations predicted for future no-build conditions are lower than the existing ambient concentrations due to the improvement of vehicle engines.

Future Build CO Concentrations, Alternatives One and Two

Alternatives One and Two both assume the same traffic conditions, and therefore, CO concentrations would be the same for both. The worst-case traffic among Build Alternatives One or Two was evaluated to predict total ambient CO concentrations, including impacts resulting from CO emissions of roadways and new parking garages, and regional backgrounds at the worst-case receptor location. As presented in Table B-29, the predicted total ambient maximum one-hour and eight-hour CO concentrations for the future Build Alternatives One and Two are 8.44 ppm and 6.50 ppm, respectively, while the NAAQS standards for one-hour and eight-hour ambient CO concentrations are 35 ppm and 9 ppm, respectively. Other options and traffic mitigations would result in even lower CO ambient concentrations. By comparing build and no-build concentrations, the predicted worst-case 8-hour impact is 0.20 ppm, and therefore is not significant.

TABLE B-29: PREDICTED AMBIENT TOTAL CO CONCENTRATIONS - FUTURE BUILD ALTERNATIVES ONE AND TWO

Site	Total Ambient 1-hour Concentration*	1-hr CO NAAQS	Total Ambient 8-hour Concentration**	8-hr CO NAAQS
	(ppm***)	(ppm)	(ppm)	(ppm)
Rockville Pike (MD 355) & Cedar Lane / North Drive	8.44	35	6.5	9
Rockville Pike (MD 355) & Wilson Drive/ North Wood Road	7.54	35	5.9	9
Rockville Pike (MD 355) & South Drive / South Wood Road	6.44	35	5.1	
Rockville Pike (MD 355) & Jones Bridge	8.14	35	6.3	9
Connecticut Ave (MD 185) & Jones Bridge Road	6.44	35	5.1	9

*: Including 1-hour background 4.0 ppm and garages impacts
**: Including 8-hour background 3.4 ppm and garage impacts
***: ppm = parts per million, (For CO, 1 ppm = 1,150 ug/m^3)

6.3 Project Compliance with Regulations

Air quality impacts are evaluated by the Ambient Air Quality Standards (NAAQS), local requirements, and the rules for conformity. For determining whether a project conforms to the regulations, a proposed project shall not cause or contribute to any new violation of the standard; as well as shall not increase the frequency or severity of any existing violation; and shall not delay timely attainment of the standards.

As described above, all estimated concentrations for the no-build and build scenarios are well below the NAAQS standards, and thus no violations were predicted of one-hour or eight-hour NAAQS at any sites. The predicted maximum project impact on 8-hour CO concentration, including effects of garages emissions, is 0.2 ppm which is also not significant.

Thus, it is projected that the proposed project will not create any new violation, nor increase the frequency or severity of any existing violations of the NAAQS standards. Therefore, the proposed project would not delay the timely attainment of the NAAQS, and would comply with the conformity rules and the requirements of the Clean Air Act.

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ATTACHMENT ONE: RECORD OF NON-APPLICABILITY

GENERAL CONFORMITY – RECORD OF NON-APPLICABILITY

Project/Action
Name: Activities to Implement the 2005 Base Realignment and Closure Directed and Related at National Naval Medical Center, Bethesda, Maryland

Project/Action
Identification Number: ____________________

Project/Action
Point of Contact: Brian Hillis
Environmental Scientist
Environmental Planning Department
National Naval Medical Center

Begin Date: May 01, 2008
End Date: September 15, 2011

General Conformity under the Clean Air Act, Section 176 has been evaluated for the project described above according to the requirements of 40 CFR 93, Subpart B. The General Conformity Rule applies to federal actions occurring in regions designated as being in non-attainment for the National Ambient Air Quality Standards (NAAQS) or attainment areas subject to maintenance plans (maintenance areas). Threshold *(de minimi*s) rates of emissions have been established for federal actions with the potential to have significant air quality impacts. If a project/action located in an area designated as non-attainment exceeds these *de mimimis* levels, a general conformity analysis is required. NNMC is in Montgomery County which is in moderate nonattainment for ozone and in nonattainment for particulate matter with diameter less than or equal to 2.5 micrometers ($PM_{2.5}$), and is in maintenance for carbon monoxide. Thus the thresholds for ozone precursor pollutants nitrogen oxides (NOx) and volatile organic compounds (VOCs), for $PM_{2.5}$, and the $PM_{2.5}$ precursor pollutant sulfur dioxide SO_2, and for carbon monoxide (CO) apply.

A General Conformity Analysis of this project/action is not required because total maximum annual direct and indirect emissions from this project/action have been estimated at:

NO_X: 45.78 tons per year, VOCs: 22.16 tons per year, $PM_{2.5}$: 18.23 tons per year, SO_2: 5.79 tons per year, and CO: 20.33 tons per year

These are below the *de minimis* levels established in 40 CFR 93.153 (b) of:

NO_x, $PM_{2.5}$, CO, SO_2: 100 tons per year; VOC: 50 tons per year.

Montgomery County is in attainment for all other criteria pollutants particulate matter (PM_{10}) and lead (Pb) and therefore, these pollutants are not subject to conformity review.

Supporting documentation and emissions estimates can be found in Section 4.4 and Appendix B of the Environmental Impact Statement.

Authorized Signature