# Appendix C: Air Quality Analysis Report

# Air Quality Assessment
# Eisenhower West Industrial Land Use Study

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# Table of Contents

**1.0 INTRODUCTION ..... 1**

1.1 POLLUTANTS OF CONCERN ..... 1

**2.0 BASELINE EMISSIONS FROM INDUSTRIAL OPERATIONS IN THE STUDY AREA ..... 1**

2.1 DESCRIPTION OF THE FOUR INDUSTRIAL OPERATIONS ..... 1
2.2 CRITERIA AIR POLLUTANT EMISSIONS ..... 2
2.3 HAZARDOUS AIR POLLUTANT EMISSIONS ..... 3
2.4 GREENHOUSE GAS EMISSIONS ..... 4

**3.0 BASELINE EMISSIONS FROM VEHICLES IN THE STUDY AREA ..... 4**

3.1 GENERAL PUBLIC TRAFFIC DATA ..... 5
3.2 INDUSTRIAL OPERATIONS TRAFFIC DATA ..... 6
3.2 CRITERIA AIR POLLUTANT EMISSIONS ..... 9
3.3 HAZARDOUS AIR POLLUTANT EMISSIONS ..... 9
3.4 GREENHOUSE GAS EMISSIONS ..... 9

**4.0 BASELINE EMISSIONS IN THE STUDY AREA COMPARED TO CITY-WIDE EMISSIONS ..... 10**

**5.0 BASELINE AMBIENT AIR QUALITY ..... 11**

**6.0 PROJECTED EMISSIONS FOR EACH ALTERNATIVE ..... 12**

6.1 ESTIMATES OF NEW TRAFFIC GENERATION BY EACH REDEVELOPMENT ALTERNATIVE ..... 14
6.2 EMISSIONS ASSOCIATED WITH NEW TRAFFIC GENERATION ..... 15
6.3 COMPARISON OF EMISSION CHANGES FOR EACH REDEVELOPMENT ALTERNATIVE ..... 16

**7.0 PROJECTED AMBIENT AIR QUALITY FOR EACH ALTERNATIVE ..... 21**

# List of Exhibits


| | |
|---|---|
| Exhibit 1 | Stationary Source Emissions from Industrial Sources in the Eisenhower West Area |
| Exhibit 2 | Roadways Included in Eisenhower West Area |
| Exhibit 3 | 2007 Traffic Data for All Vehicles on Major Roadways in the Eisenhower West Area |
| Exhibit 4 | Estimated Truck Traffic Associated with the Industrial Operations |
| Exhibit 5 | Onroad Vehicle Emissions in the Eisenhower West Area |
| Exhibit 6 | Emissions in the Eisenhower West Area Compared to City-wide Emissions |
| Exhibit 7 | Air Quality Trends in Alexandria 1980 to 2008 |
| Exhibit 8 | Assumptions Regarding Emission Changes for Each Alternative |
| Exhibit 9 | Traffic Estimates for Redevelopment Alternatives |
| Exhibit 10 | Emission Estimates for Vehicle Traffic Associated with Redevelopment Alternatives |
| Exhibit 11 | Emission Estimates in the Study Area for Alternative A |
| Exhibit 12 | Emission Estimates in the Study Area for Alternative B |
| Exhibit 13 | Emission Estimates in the Study Area for Alternative C |
| Exhibit 14 | Emission Estimates in the Study Area for Alternative D |

# 1.0 Introduction

The air quality assessment includes six sections in addition to this Introduction. First, we summarize the air pollutant emissions from the four industrial sources in the Eisenhower West area, both from the industrial operations and related vehicle traffic. In Section 3, we compare the emissions from these four industrial sources to other emission sources in the surrounding community. Baseline air quality levels are summarized and compared to the health-based NAAQS. The fifth subsection summarizes how emissions in the Eisenhower West area will change under each redevelopment alternatives. Finally, we present a qualitative assessment of how ambient air quality levels will change under the different redevelopment alternatives.

## 1.1 Pollutants of Concern

The Clean Air Act requires the U.S. Environmental Protection Agency (USEPA) to set National Ambient Air Quality Standards (NAAQS) for common air pollutants. The USEPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible exposure levels. The NAAQS are for particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

The USEPA also regulates Hazardous Air Pollutants (HAPs), a group of 187 chemicals such as arsenic, benzene, formaldehyde, mercury, and dioxins. Some HAPs are known or suspected to cause cancer. Other HAPs may cause respiratory effects, birth defects, and reproductive and other serious health effects.

A third group of air pollutants, primarily carbon dioxide and methane, are classified as Greenhouse Gases (GHGs). These pollutants are linked to global climate change, and the City is beginning to address GHG emissions through the Environmental Action Plan.

# 2.0 Baseline Emissions from Industrial Operations in the Study Area

## 2.1 Description of the Four Industrial Operations

The Covanta Energy-from-Waste Facility is located at 5301 Eisenhower Avenue. The waste is incinerated and the heat is converted into electricity and sold to the Dominion Virginia Power grid. The facility supplies enough electricity to power approximately 20,000 homes in Northern Virginia. The City of Alexandria and Arlington County co-own the energy-from-waste facility, which is operated under contract by Covanta Energy. In response to Clean Air Act requirements, Arlington County funded a $45 million pollution control upgrade in 2000. The retrofit dramatically lowered emissions of both criteria and hazardous air pollutants. The air pollution control equipment improvements consisted of semi-dry flue gas scrubbers injecting lime, fabric filter baghouses, a

nitrogen oxide control system, a mercury control system, and a continuous emissions monitoring (CEM) system. The facility operates under a Title V operating permit that sets emission limitations and all emissions parameters are measured continuously against those limits.

The Alexandria branch of the Virginia Paving Company produces asphalt for projects in and around the City of Alexandria and on projects such as the new Woodrow Wilson Bridge, the Springfield Interchange, I-395, and the Beltway. Hot mix asphalt is produced by heating and mixing liquid asphalt with various aggregates such as rocks, sand, and crushed recycled asphalt pavement. The City issued a revised Special Use Permit (SUP) in November of 2006. The SUP included 78 conditions to improve operational conditions at the facility, enhance environmental protection, and provide the City with the authority to enforce compliance with those conditions. The SUP includes a series of improvements to reduce total emissions from the facility. These projects address not only the emissions from the drum dryer stacks, but also fugitive emissions from material transfer areas, and emissions from diesel powered machinery.

Vulcan Materials Company operates a facility at 701 South Van Dorn Street to stockpile stone and raw materials used for development in the metropolitan area. A concrete recycling facility is also located on the site. The City amended a SUP in 1996 which sets conditions for minimizing fugitive dust emissions from the facility during loading, unloading, and storage operations. Coarse particulate emissions are generated by trucks traveling on plant roads and by wind erosion of aggregate storage piles.

Norfolk Southern Corporation’s Ethanol Transloading Facility, which began operation in April 2008. The facility is located at the former Norfolk Southern intermodal terminal in the City’s West End. Ethanol cannot travel in pipelines along with gasoline, because it picks up excess water and impurities. As a result, it must be transported via trucks, trains or barges. Norfolk Southern ships liquid ethanol by rail car to its facility, where the material is transloaded (off-loaded by the railroad's contractor into tanker trucks) for final delivery to gasoline tank farms in Springfield and in Fairfax City. Emissions of volatile organic compounds occur as organic vapors in "empty" cargo tanks are displaced to the atmosphere by the liquid being loaded into the tanks. Coarse particulate emissions are generated by trucks traveling on plant roads.

## 2.2 Criteria Air Pollutant Emissions

Exhibit 1 summarizes the criteria air pollutant emissions from the four industrial facilities in the Eisenhower West area. The Covanta facility is the largest emitter of CO, NOx, and SO2. The Virginia Paving facility is the largest emitter of particulate matter and VOC. The Vulcan Materials facility emits a small amount of particulate matter. The Norfolk Southern facility emits a small amount of VOC.

**Exhibit 1 – Stationary Source Emissions from Industrial Sources in the Eisenhower West Area**

| Facility | Emissions in 2007 (tons/yr) | | | | | |
|---|---|---|---|---|---|---|
| | CO | NOx | PM10 | PM2.5 | SO2 | VOC |
| Covanta Energy-from-Waste Facility[1] | 61.8 | 575.2 | 2.8 | 2.8 | 12.6 | 2.3 |
| Virginia Paving[1] | 12.9 | 12.5 | 4.4 | 4.4 | 5.2 | 3.9 |
| Vulcan Materials[2] | 0.0 | 0.0 | 0.3 | <0.1 | 0.0 | 0.0 |
| Norfolk Southern Transloading Facility[3] | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | <0.1 |
| **Total** | **74.7** | **587.7** | **7.6** | **7.3** | **17.8** | **6.2** |

[1] Source: http://www.deq.virginia.gov/air/emissions/inventory.html

[2] Calculated using emission factors from AP-42 Section 13.2.5 (Industrial Wind Erosion). Plant area is 11.6 acres.

[3] Calculated using emission factors from AP-42 Section 5.2 (transportation of petroleum liquids). T&ES haul permit limits facility to 20 trucks per day. Each truck holds about 8,000 gallons. Assuming operation for 5 days per week and 52 weeks per year, the maximum amount of ethanol transloaded per year is about 2 million gallons. Trucks are typically controlled with vapor recovery systems that prevent about 95% of the vapors from escaping to the atmosphere.

Criteria Air Pollutants
- CO – carbon monoxide
- NOx – oxides of nitrogen
- PM10 – particulate matter less than 10 microns in diameter
- PM2.5 – particulate matter less than 2.5 microns in diameter
- SO2 – sulfur dioxide
- VOC – volatile organic compounds

## 2.3 Hazardous Air Pollutant Emissions

Hazardous air pollutants (HAPs), also known as toxic air pollutants or air toxics, are those pollutants that cause or may cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental and ecological effects. The USEPA is required to control 187 hazardous air pollutants.

The industrial operations at Vulcan Materials and the Norfolk Southern transloading facility do not generate HAPs. The chemical composition of the emissions from Vulcan Materials is primarily mineral oxides and other naturally occurring crustal materials that are not classified as HAPs. The emissions from Norfolk Southern are primarily ethanol, which is not classified as a HAP.

The Covanta Energy-from-Waste facility is permitted to emit small amounts of metals (cadmium, lead, mercury), acid gases (hydrogen chloride) and organics (dioxins and furans). In response to Clean Air Act requirements, Arlington County funded a $45 million pollution control upgrade in 2000. The retrofit dramatically lowered emissions of both criteria and hazardous air pollutants. The facility achieves emission results that are in compliance with the permitted levels.

Virginia Paving is permitted to combust distillate oil, recycled fuel oil, and natural gas. The recycled fuel oil contains small amounts of arsenic, cadmium, chromium, lead, PCBs, and halogens. Virginia Paving is required to obtain a certification from the recycled/used oil supplier, including sampling and analysis representative of each shipment purchased, to ensure that the levels of these chemicals meet specifications designed to protect human health.

### 2.4 Greenhouse Gas Emissions

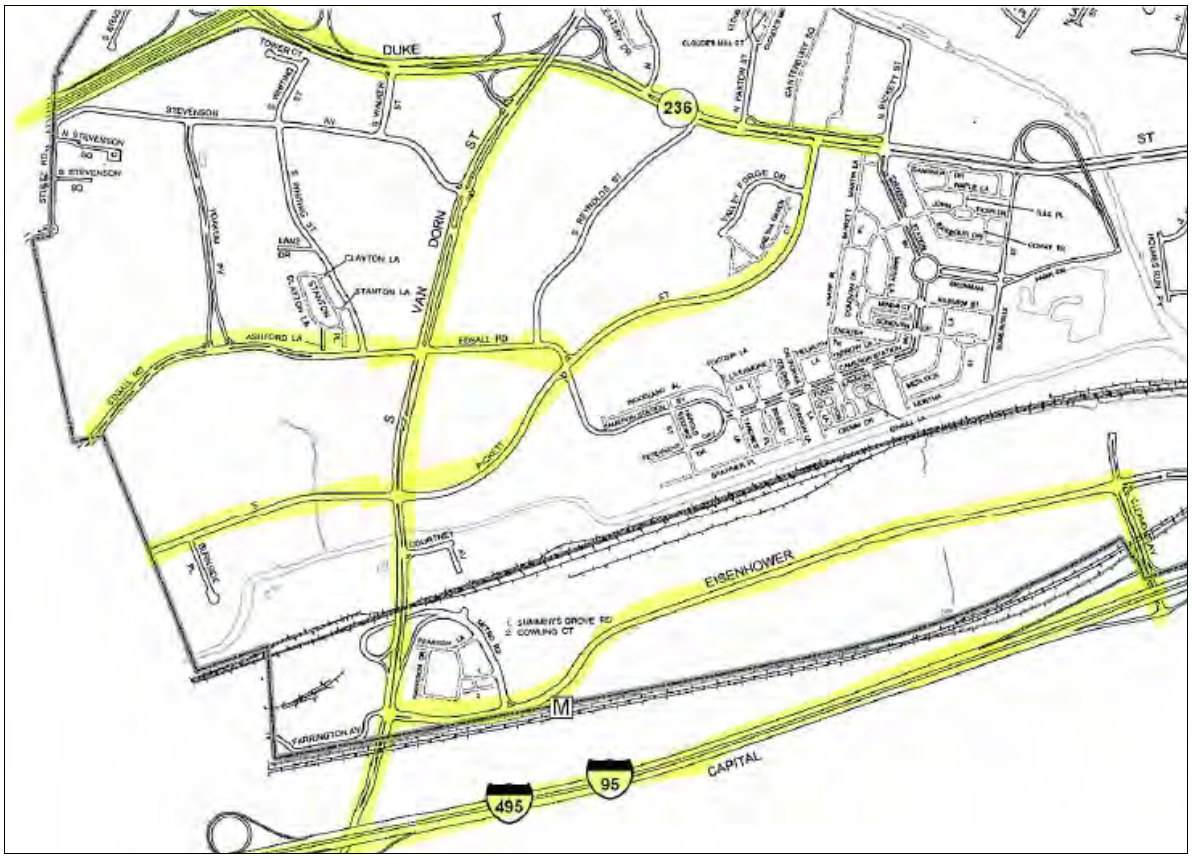
The industrial operations at Vulcan Materials and the Norfolk Southern transloading facility do not generate GHGs. The Virginia Paving facility generates a small amount of GHGs from the combustion of distillate oil, recycled oil, and natural gas. Although the Covanta energy-from-waste facility generates GHGs, disposing of solid waste at the facility helps prevent climate change in several ways: (1) the facility avoids methane production that would occur if the trash was sent directly to a landfill; (2) the facility generates cleaner energy and reduces the amount of electricity generated from fossil fuels; and (3) by recovering steel from the waste stream, the facility reduces the quantity of fossil fuels and energy used for mining and manufacturing raw materials. It is estimated that for every ton of trash combusted, nearly one ton less of carbon dioxide equivalent is released into the air due to avoided methane from land disposal, fossil fuel power generation, and metals productions.

## 3.0 Baseline Emissions from Vehicles in the Study Area

We evaluated emissions from vehicle traffic in the Eisenhower West area. Emissions were calculated for vehicle traffic associated with the industrial operations as well as emissions from all types of vehicle traffic.

The study area boundaries for the purposes of the emissions analysis are shown in Exhibit 3 (note that portions of I-395 and I-95/I-495 in Fairfax County are not shown on the map). The southern boundary is the segment of the Capital Beltway from Clermont Avenue to I-395/I-495/I-95 Springfield Interchange. The western boundary is the segment of I-395 from the Springfield Interchange to Route 236/Duke Street. The northern boundary is Duke Street from I-395 to North Pickett Street. The eastern boundary is the line connecting the Duke Street/North Pickett intersection and the Clermont Avenue/Capital Beltway Interchange. Included in the study area are South Van Dorn Street, South Pickett Street, and Edsall Road.

**Exhibit 2 – Roadways Included in Eisenhower West Area**




## 3.1 General Public Traffic Data

The Virginia Department of Transportation (VDOT) operates a Traffic Monitoring System and produces a number of reports of vehicle traffic on the public roads of Virginia. For the roadways in the study area, we obtained the 2007 annual average daily traffic (AADT) and link length for the major roadway segments in the study area. We calculated the annual vehicle miles travelled (VMT) on each segment using the following equation:

*Annual VMT (miles/year) = AADT (vehicles/day) * Link Length (miles) * 365 days/year*

A summary of the traffic data from all vehicles is shown in Exhibit 3.

**Exhibit 3 – 2007 Traffic Data for All Vehicles on Major Roadways in the Eisenhower West Area**

| Route Alias | Link Length | Start Label | End Label | AADT | Annual VMT |
|---|---|---|---|---|---|
| Capital Beltway NB | 1.54 | 29-613 Van Dorn St | Eisenhower Ave Connector | 74,000 | 41,595,399 |
| Capital Beltway SB | 1.20 | 29-613 Van Dorn St | Eisenhower Ave Connector | 64,000 | 28,032,001 |
| Capital Beltway NB | 0.96 | I-495 | 29-613 Van Dorn St | 78,000 | 27,331,199 |
| Capital Beltway SB | 1.22 | I-495 | 29-613 Van Dorn St | 68,000 | 30,280,401 |
| I-395 NB | 1.11 | I-495 Capital Beltway | 29-648 Edsall Rd | 74,000 | 29,981,100 |
| I-395 NB | 0.91 | 29-648 Edsall Rd | Reversible Lane Ramps | 75,000 | 24,911,251 |
| I-395 NB | 0.51 | Reversible Ramps | WCL Alexandria | 76,000 | 14,147,400 |
| I-395 NB | 0.21 | Fairfax County Line | SR 236 Duke St | 76,000 | 5,825,400 |
| I-395 SB | 1.01 | I-495 Capital Beltway | 29-648 Edsall Rd | 68,000 | 25,068,200 |
| I-395 SB | 0.69 | 29-648 Edsall Rd | Reversible Lane Ramps | 71,000 | 17,881,350 |
| I-395 SB | 0.42 | ReversibleRamps | WCL Alexandria | 79,000 | 12,110,700 |
| I-395 SB | 0.71 | Fairfax County Line | SR 236 Duke St | 79,000 | 20,472,849 |
| I-395 Reversable | 2.83 | I-495 Capital Beltway | SR 236 Duke St | 29,000 | 29,955,550 |
| Duke St | 0.32 | I-395 | SR 401 Van Dorn St | 67,000 | 7,825,600 |
| Duke St | 0.36 | SR 401 Van Dorn St | N Pickett St | 42,000 | 5,518,800 |
| Clermont Ave | 0.13 | I 95 Ramps | 100-6588 Eisenhower Ave | 16,000 | 759,200 |
| Eisenhower Ave | 1.14 | SR 401 Van Dorn St | Clermont Ave | 14,000 | 5,825,400 |
| Van Dorn St | 0.59 | I-95; I-495 | SCL Alexandria; SR 401; | 47,000 | 10,121,450 |
| Van Dorn St | 0.62 | SCL Alexandria | Edsall Rd | 54,000 | 12,220,200 |
| Van Dorn St | 0.43 | Edsall Rd | SR 236 Duke St | 37,000 | 5,807,150 |
| Edsall Rd | 0.30 | I-395 | 29-2606 Beryl Rd | 30,000 | 3,285,000 |
| Edsall Rd | 1.08 | 29-2606 Beryl Rd | WCL Alexandria | 18,000 | 7,095,600 |
| Edsall Rd | 0.49 | WCL Alexandria | Van Dorn St | 16,000 | 2,861,600 |
| Edsall Rd | 0.24 | Van Dorn St | S Pickett St | 11,000 | 963,600 |
| S Pickett St | 0.28 | SR 401 Van Dorn St | Dead End | 5,900 | 611,790 |
| S Pickett St | 0.36 | Van Dorn St | Edsall Rd | 12,000 | 1,576,800 |
| S Pickett St | 0.57 | Edsall Rd | SR 236 Duke St | 16,000 | 3,328,800 |
| | | | | | **375,393,790** |

AADT = Annual Average Daily Traffic (# of vehicles)
VMT = vehicle miles travelled
Data Source: http://virginiadot.org/info/ct-TrafficCounts.asp ; AADT_100_Alexandria_2007.xls and AADT_029_Fairfax_2007.xls

## 3.2 Industrial Operations Traffic Data

Next, we estimated the truck traffic associated with the four industrial sources. The data used and assumptions made are summarized as follows:

- Covanta. Mr. Michael Renga of Covanta provided the following information on truck traffic associated with Covanta operations. There are about 100-150 refuse trucks per day on weekdays and 30-50 trucks on Saturdays. There are also 10-12 ash hauling trucks per day

and 2-3 ferrous metal hauling trucks per day. Covanta could not provide information on the normal truck routing patterns. We assumed that truck traffic would be allocated to four major routes: from the NW from the Landmark area via Duke Street and S. Van Dorn Street to/from Covanta; from the NE from Duke Street via S. Pickett Street and S. Van Dorn Street; from the SE from Clermont Avenue via Eisenhower Avenue; and from the SW from the Springfield Interchange via the Capital Beltway and S. Van Dorn Street. The annual VMT was estimated to be 144,144 miles.

- Virginia Paving. According to the SUP 2005-0042, there are 20 trucks in its fleet, and 20 trucks operated by independent companies that haul asphalt from its plant. Supporting information for SUP 2005-0042 indicates that the average truck traffic is 292 vehicles per day. We assumed that the facility operates a maximum of 5 days per week and 52 weeks per year, for a total of 260 days per year. We also assumed that the trucks travel to and from various construction sites using South Van Dorn Street and the Capital Beltway. We assumed that half of the trucks will travel from on the Beltway towards the Woodrow Wilson Bridge and the other half will travel on the Beltway towards the Springfield Interchange. The round trip distance traveled within the Eisenhower West study area is about 3.92 and 3.36 miles, respectively. This results in annual VMT of 276,349 miles.
- Vulcan Materials. In SUP 95-0019, the company estimated the average truck loads per day to be between 48 and 60. We used the worst case of 60 trucks per day and assumed that the facility operates a maximum of 5 days per week and 52 weeks per year, for a total of 260 days per year. SUP 95-0019 also specifies that the only acceptable route from points outside the City shall be from the Capital Beltway along South Van Dorn Street. We assumed that the trucks travel to and from various construction sites using South Van Dorn Street and the Capital Beltway. We assumed that half of the trucks will travel from on the Beltway towards the Woodrow Wilson Bridge and the other half will travel on the Beltway towards the Springfield Interchange. The round trip distance traveled within the Eisenhower West study area is about 3.92 and 3.36 miles, respectively. This results in annual VMT of 56,784 miles.
- Norfolk Southern Transloading. T&ES Haul Permit TES2008-01116 specifies that hauling is limited to 20 trucks per day. We assumed that the facility operates a maximum of 5 days per week and 52 weeks per year, for a total of 260 days per year. The trucks travel to and from gasoline tank farms in Springfield and Fairfax City along South Van Dorn Street and the Capital Beltway. The round trip distance traveled within the Eisenhower West study area is about 3.36 miles. This results in annual VMT of 17,472 miles.

A summary of the truck traffic data associated with the industrial operations is shown in Exhibit 4.

## Exhibit 4 – Estimated Truck Traffic Associated with the Industrial Operations

| Route Alias | Link Length | Start Label | End Label | AADT | Annual VMT |
|---|---|---|---|---|---|
| **Covanta** | | | | | |
| NW Route | 1.06 | Leaving Covanta via S. Van Dorn to Duke St. to I-395 | | 40 | 11,024 |
| NW Route | 1.06 | Arriving Covanta from I-395 via Duke St. to S. Van Dorn | | 40 | 11,024 |
| NE Route | 1.24 | Leaving Covanta via S. Pickett to Duke Street | | 40 | 12,896 |
| NE Route | 1.24 | Arriving Covanta via from Duke Street via S. Pickett to S. Van Dorn | | 40 | 12,896 |
| SE Route | 1.27 | Leaving Covanta via Eisenhower Avenue | | 40 | 13,208 |
| SE Route | 1.27 | Arriving Covanta via Eisenhower Avenue | | 40 | 13,208 |
| SW Route | 3.36 | Leaving Covanta via S. Van Dorn to Springfield Interchange | | 40 | 34,944 |
| SW Route | 3.36 | Arriving Covanta via Springfield Interchange and S. Van Dorn | | 40 | 34,944 |
| | | | | | **144,144** |
| **Virginia Paving** | | | | | |
| Van Dorn St SB | 0.59 | Vulcan Materials | Capital Beltway NB | 146 | 22,396 |
| Capital Beltway NB | 1.54 | Van Dorn St | Eisenhower Ave Connector | 146 | 58,458 |
| Capital Beltway SB | 1.20 | Eisenhower Ave Connector | Van Dorn St | 146 | 45,552 |
| Van Dorn St NB | 0.59 | Capital Beltway NB | Vulcan Materials | 146 | 22,396 |
| Van Dorn St SB | 0.59 | Vulcan Materials | Capital Beltway SB | 146 | 22,396 |
| Capital Beltway SB | 1.22 | Van Dorn St | Springfield Interchange | 146 | 46,311 |
| Capital Beltway NB | 0.96 | Springfield Interchange | Van Dorn St | 146 | 36,442 |
| Van Dorn St NB | 0.59 | Capital Beltway NB | Vulcan Materials | 146 | 22,396 |
| | | | | | **276,349** |
| **Vulcan Materials** | | | | | |
| Van Dorn St SB | 0.59 | Vulcan Materials | Capital Beltway NB | 30 | 4,602 |
| Capital Beltway NB | 1.54 | Van Dorn St | Eisenhower Ave Connector | 30 | 12,012 |
| Capital Beltway SB | 1.20 | Eisenhower Ave Connector | Van Dorn St | 30 | 9,360 |
| Van Dorn St NB | 0.59 | Capital Beltway NB | Vulcan Materials | 30 | 4,602 |
| Van Dorn St SB | 0.59 | Vulcan Materials | Capital Beltway SB | 30 | 4,602 |
| Capital Beltway SB | 1.22 | Van Dorn St | Springfield Interchange | 30 | 9,516 |
| Capital Beltway NB | 0.96 | Springfield Interchange | Van Dorn St | 30 | 7,488 |
| Van Dorn St NB | 0.59 | Capital Beltway NB | Vulcan Materials | 30 | 4,602 |
| | | | | | **56,784** |
| **Norfolk Southern** | | | | | |
| Van Dorn St SB | 0.59 | Norfolk Southern | Capital Beltway SB | 20 | 3,068 |
| Capital Beltway SB | 1.22 | Van Dorn St | Springfield Interchange | 20 | 6,344 |
| Capital Beltway NB | 0.96 | Springfield Interchange | Van Dorn St | 20 | 4,992 |
| Van Dorn St NB | 0.59 | Capital Beltway NB | Norfolk Southern | 20 | 3,068 |
| | | | | | **17,472** |

AADT = Annual Average Daily Traffic (# of vehicles)
VMT = vehicle miles travelled

## 3.2 Criteria Air Pollutant Emissions

We used standard USEPA emission factor models to predict gram per mile emissions from vehicle traffic. We used the MOBILE6.2 model to predict emissions factors for vehicle exhaust, tire and break wear, and evaporative emissions. Inputs to the MOBILE6.2 model were obtained from the Metropolitan Washington Council of Governments. We used the emission factor equation given in AP-42 Section 13.2.1 (Paved Roads) for predicting particulate emissions of re-entrained road dust.

Exhibit 5 summarizes the criteria air pollutant emissions from the vehicle traffic in the Eisenhower West area. The truck traffic associated with the four industrial facilities accounts for only 0.13 percent of the total VMT and a small percentage of the total emissions in the study area.

**Exhibit 5 – Onroad Vehicle Emissions in the Eisenhower West Area**

| Source | VMT | Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|---|
| | | CO | NOx | PM10 | PM2.5 | SO2 | VOC |
| **All Vehicles in Study Area** | | | | | | | |
| All Vehicles | 375,393,790 | 2,612 | 553 | 145 | 11 | 4 | 204 |
| **Truck Traffic Associated with Industrial Operations** | | | | | | | |
| Covanta | 144,144 | 0.3 | 1.2 | 1.3 | 0.2 | <0.1 | 0.1 |
| Virginia Paving | 276,349 | 0.6 | 2.3 | 2.5 | 0.4 | <0.1 | 0.1 |
| Vulcan Materials | 56,784 | 0.1 | 0.5 | 0.5 | 0.1 | <0.1 | <0.1 |
| Norfolk Southern | 17,472 | <0.1 | 0.1 | 0.2 | <0.1 | <0.1 | <0.1 |
| **Total** | **494,749** | **1.0** | **4.2** | **4.5** | **0.7** | **<0.1** | **0.2** |
| **Contribution from Industrial Source Vehicle Traffic** | **0.13%** | **0.04%** | **0.8%** | **3.1%** | **6.3%** | **0.2%** | **0.1%** |

## 3.3 Hazardous Air Pollutant Emissions

Motor vehicles also emit a number of HAPs, both in the exhaust gas and from fuel evaporation. The two primary HAPs emitted from motor vehicles are benzene and methyl tert-butyl ether (MTBE). The truck traffic associated with the four industrial facilities accounts for about 0.031 tons of benzene, compared to 23.2 tons of benzene from all other vehicles in the study area. The truck traffic associated with the four industrial facilities accounts for about 0.034 tons of MTBE, compared to 25.6 tons of MTBE from all other vehicles in the study area.

## 3.4 Greenhouse Gas Emissions

We also calculated GHG emissions from the vehicle traffic in the Eisenhower West area. The truck traffic associated with the four industrial facilities accounts for about 752 tons of CO2, compared to 216,343 tons of CO2 from all other vehicles in the study area.

## 4.0 Baseline Emissions in the Study Area Compared to City-Wide Emissions

The previous two sections discussed the emissions from the stationary industrial operations and associated truck traffic in the Eisenhower West area. This section compares the emissions in the study area to the emissions throughout the City of Alexandria. Emission sources into are generally grouped into four major categories, as follows:

- *Point Sources* are comprised of stationary facilities that emit pollutants above a certain threshold, from a stack, vent or similar discrete point of release. In Alexandria, the Mirant Potomac River Generating Station and the Covanta energy-from-waste plant are the top-emitting point sources.
- *Area Sources* consist of numerous small sources diffused over a wide geographical area. Area sources include sources that in and of themselves are insignificant, but in aggregate may comprise significant emissions. Examples would be emissions from small dry cleaners, gasoline stations, home heating boilers, and VOCs volatizing from house painting or consumer products.
- *Mobile Onroad Sources* include internal combustion engines used to propel cars, trucks, buses, and other vehicles on public roadways. Emissions are typically estimated using USEPA emission factor and transportation planning models. Emissions are calculated by road type, vehicle type, and fuel type.
- *Mobile Nonroad Sources* are sources of air pollution from internal combustion engines used to propel trains, airplanes, and marine vessels, or to operate equipment such as forklifts, lawn and garden equipment, portable generators, etc.

Exhibit 6 summarizes the criteria air pollutant emissions in the Eisenhower West study area and the City-wide emissions. Criteria air pollutant emissions from the four industrial sources in the Eisenhower West comprise a very small fraction of the total City-wide emissions.

**Exhibit 6 – Emissions in the Eisenhower West Area Compared to City-wide Emissions**

| **ALEXANDRIA** | **Emissions (tons/yr)** | | | | | |
|---|---|---|---|---|---|---|
| **Source Type** | **CO** | **NOx** | **PM10** | **PM2.5** | **SO2** | **VOC** |
| **City of Alexandria** | | | | | | |
| Point Sources | 260 | 2,937 | 113 | 31 | 3,768 | 27 |
| Area Sources | 1,386 | 548 | 2,276 | 502 | 543 | 2,144 |
| Onroad Mobile Sources | 9,314 | 916 | 26 | 14 | 21 | 601 |
| Nonroad Mobile Sources | 7,346 | 171 | 19 | 18 | 10 | 446 |
| **Total for Alexandria** | **18,306** | **4,572** | **2,434** | **564** | **4,342** | **3,218** |
| **Industrial Sources in Eisenhower West Area** | | | | | | |
| Point Sources | 75 | 588 | 8 | 7 | 18 | 6 |
| Onroad Mobile Sources | 1 | 4 | 4 | 1 | <0.1 | <0.1 |
| **Total for Industrial Sources** | **76** | **592** | **12** | **8** | **18** | **6** |
| **Percentage of Total Emissions** | **0.4%** | **12.9%** | **0.5%** | **1.4%** | **0.4%** | **0.2%** |

The HAP emissions from the industrial sources likewise make up a very small fraction of the City-wide total HAP emissions. For example, the truck traffic associated with the four industrial facilities

accounts for about 0.034 tons of MTBE, compared to 25.6 tons of MTBE from all other vehicles in the study area and 129 tons City-wide. Finally, GHG emissions from the industrial sources also make up a very small fraction of the City-wide total HAP emissions. For example, the truck traffic associated with the four industrial facilities accounts for about 752 tons of CO2, compared to 216,343 tons of CO2 from all other vehicles in the study area and 1.2 million tons City-wide.

## 5.0 Baseline Ambient Air Quality

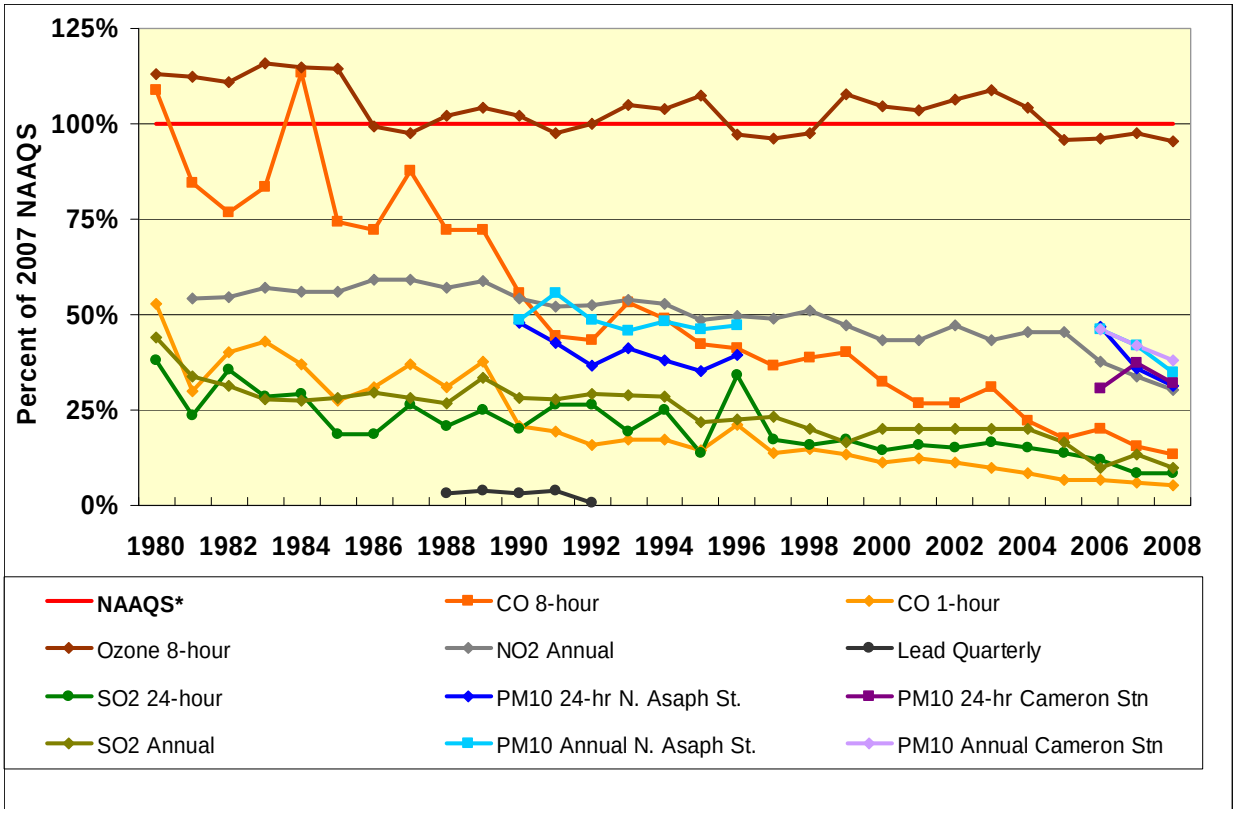
The City of Alexandria has been taking measurements of air quality for nearly 50 years. Alexandria participated in the MWCOG's Oxidant Sampling Network beginning in October, 1961. By the mid-1970s, Alexandria had one of the most sophisticated air monitoring networks in the Metropolitan area. The Office of Environmental Quality (OEQ) currently maintains and operates an ambient air monitoring station at 517 North St. Asaph Street. Carbon monoxide, sulfur dioxide, nitrogen dioxide, and particulate matter ($PM_{10}$) are measured year round. Ozone is continuously measured during the months of April through September. The City also began monitoring $PM_{10}$ concentrations at a site in Cameron Station in 2006. VADEQ and Arlingon/Fairfax Counties also monitor air quality at locations near Alexandria, including sites in Annandale, Franconia, Mt. Vernon, and Seven Corners.

As shown in Exhibit 7, air quality data collected in Alexandria show that air quality has generally improved since the early 1980s. Since 2005, measured concentrations of all criteria pollutants were better than the NAAQS. Although the ozone concentrations measured in Alexandria were better than the 1997 NAAQS in 2005-2008, Alexandria is part of the Metropolitan Washington region and violations of the NAAQS have been measured at other monitors in the region. Thus, Alexandria is considered to be nonattainment for ozone under the 1997 NAAQS. The USEPA strengthened the NAAQS for ozone in 2008, effectively reducing the levels from 0.084 ppm to 0.075 ppm. Alexandria's ozone levels in 2008 exceeded the new 2008 ozone standard.

There is no VADEQ PM2.5 monitor operating in the city; however, the State operates PM2.5.monitors at nearby sites in Arlington and Fairfax that adequately characterize fine particulate air quality in the city. Mirant also monitors PM2.5 near its facility. Since Alexandria is part of the Metropolitan Washington region and violations of the NAAQS have been measured at other monitors in the region, Alexandria was initially considered to be nonattainment for PM2.5. On January 12, 2009, the USEPA determined that region has attained the 1997 annual PM2.5 NAAQS, based on air quality data for 2004 to 2008. In December 2006, USEPA revised the 24-hour NAAQS for PM2.5 from 65 to 35 µg/m3. In December 2008, USEPA determined that all of Virginia attained the revised 2006 24-hour NAAQS for PM2.5 .

The City began monitoring ambient air for particulate matter in June of 2004 at a new monitoring station located at Armistead Boothe Park, near the Samuel Tucker Elementary School in Cameron Station. The monitoring was conducted to measure the ambient air concentrations of PM10 in the air surrounding Cameron Station. Long-term monitoring at this location started in June of 2006. A comparison of the monitoring results with the NAAQS shows that the ambient PM10 concentrations at Cameron Station are well in compliance with the NAAQS. The highest 24-hour concentration measured to date was 56 µg/m3, well below the 24-hour PM10 standard of 150 µg/m3.

**Exhibit 7 - Air Quality Trends in Alexandria 1980 to 2008**




Notes: (1) Percent of NAAQS based on NAAQS as of Dec. 31, 2007 (does not reflect revised 2008 ozone or lead standards)

(2) Lead was monitored at Cameron Station from 1988-1992. Measured values were much better than the NAAQS. For that reason, lead monitoring was discontinued in 1992.

(3) $PM_{10}$ monitoring in the City was conducted from 1991 to 1996, discontinued in 1997, and reinstated in 2006.

## 6.0 Projected Emissions for Each Alternative

Exhibit 8 summarized the redevelopment scenarios and the assumptions made regarding the anticipated changes in air pollution emissions resulting from each alternative. For the industrial stationary sources, we assumed that the emission levels would remain the same but the location of the emissions would change. For the truck traffic associated with the industrial sources, we that

industrial truck traffic in the West End would be eliminated, except for Alternative C where truck traffic for Norfolk Southern and Covanta would be unchanged from the baseline. For vehicle traffic association with new residential / retail / office development, we calculated emissions based on the likely traffic volumes generated by each type of development. Details of the emission calculation methodology and results are presented in the following paragraphs.

**Exhibit 8 – Assumptions Regarding Emission Changes for Each Alternative**

| | **2. Redevelopment Alternative** | | | |
|---|---|---|---|---|
| **Source Type** | **4. A** | **5. B** | **6. C** | **7. D** |
| Industrial Stationary Sources | Virginia Paving, Vulcan Materials, Norfolk Southern emission sources relocated to Springfield<br><br>Covanta EfW facility in Alexandria is closed; solid waste sent to transfer station for ultimate disposal | Virginia Paving, Vulcan Materials, Norfolk Southern emission sources relocated to Springfield<br><br>Covanta EfW facility in Alexandria is closed; solid waste sent to transfer station for ultimate disposal | Virginia Paving and Vulcan Materials emission sources relocated to Springfield<br><br>Norfolk Southern and Covanta EfW emission sources retained at existing site | Virginia Paving, Vulcan Materials, Norfolk Southern emission sources relocated to Springfield<br><br>Covanta EfW facility in Alexandria is closed; solid waste sent to transfer station for ultimate disposal |
| Industrial Truck Traffic | Virginia Paving / Vulcan Materials Norfolk Southern trucks no long travel on West End roadways<br>Covanta trash trucks travel 25 miles to transfer station; larger trucks haul waste 75 miles | Virginia Paving / Vulcan Materials Norfolk Southern trucks no long travel on West End roadways<br>Covanta trash trucks travel 25 miles to transfer station; larger trucks haul waste 75 miles | Virginia Paving / Vulcan Materials trucks no long travel on West End roadways<br>Norfolk Southern and Covanta trash truck traffic unchanged from current situation | Virginia Paving / Vulcan Materials Norfolk Southern trucks no long travel on West End roadways<br>Covanta trash trucks travel 25 miles to transfer station; larger trucks haul waste 75 miles |
| Vehicle Traffic Associated with New Development | Residential Units 714<br>Office Space 1,100,000 sq.ft.<br>Retail Space 50,000 sq.ft. | Residential Units 530<br>Office Space 1,100,000 sq.ft.<br>Retail Space 50,000 sq.ft. | Residential Units 714<br>Office Space 0 sq.ft.<br>Retail Space 40,000 sq.ft. | Residential Units 1,121<br>Office Space 600,000 sq.ft.<br>Retail Space 50,000 sq.ft. |

## 6.1 Estimates of New Traffic Generation by Each Redevelopment Alternative

The new residential/retail/office redevelopment in the West End will create additional vehicle traffic and emissions. We used the 7th Edition of the Institute of Transportation Engineers *Trip Generation Report* to estimate the number of trips generated by each type of redevelopment. The trip generation rates were used to calculate the average daily traffic associated with each type of type of development. For Alternative D which includes transit oriented development (TOD), recent research shows that trip rates associated with TOD development averages around one-half of the rate for non-TOD (source: Transit Cooperative Research Program, *Effects of TOD on Housing, Parking, and Travel*). For Alternative D, we reduced the trip generation rates by 50% to account for the reduced vehicle travel associated with TOD. We assumed that the distance traveled in the West End for each trip would equal the length of South Van Dorn Street from the Beltway to Duke Street (1.64 miles). We calculated the annual vehicle miles travelled (VMT) on each segment using the following equation:

*Annual VMT (miles/year) = AADT (vehicles/day) * Link Length (miles) * 365 days/year*

A summary of the traffic estimates associated with new development is shown in Exhibit 9.

**Exhibit 9 – Traffic Estimates for Redevelopment Alternatives**

| | A | B | C | D |
|---|---|---|---|---|
| Residential Units | 714 | 530 | 714 | 1,121 |
| Office Sq. Ft. | 1,100,000 | 1,100,000 | 0 | 600,000 |
| Retail, Sq. Ft | 50,000 | 50,000 | 40,000 | 50,000 |
| **Trip Generation Rates** | | | | |
| Residential (trips/day per unit) | 7.0 | 7.0 | 7.0 | 3.5 |
| Office (trips/day per 1000 Sq. Ft.) | 11.0 | 11.0 | 11.0 | 5.5 |
| Retail (trips/day per 1000 Sq. Ft.) | 42.9 | 42.9 | 42.9 | 21.5 |
| **Average Daily Traffic** | | | | |
| Residential | 4,998 | 3,710 | 4,998 | 3,924 |
| Office | 12,111 | 12,111 | 0 | 3,303 |
| Retail | 2,147 | 2,147 | 1,718 | 1,075 |
| | **19,256** | **17,968** | **6,716** | **8,302** |
| **Link Length (miles)** | | | | |
| Van Dorn - Beltway to Duke Street | 1.64 | 1.64 | 1.64 | 1.64 |
| **Annual Vehicle Miles Traveled** | | | | |
| Residential | 2,991,803 | 2,220,806 | 2,991,803 | 2,348,607 |
| Office | 7,249,645 | 7,249,645 | 0 | 1,977,176 |
| Retail | 1,285,194 | 1,285,194 | 1,028,155 | 643,495 |
| | **11,526,642** | **10,755,645** | **4,019,958** | **4,969,278** |

## 6.2 Emissions Associated with New Traffic Generation

We used standard USEPA emission factor models to predict gram per mile emissions from vehicle traffic. We used the MOBILE6.2 model to predict emissions factors for vehicle exhaust, tire and break wear, and evaporative emissions. Inputs to the MOBILE6.2 model were obtained from the Metropolitan Washington Council of Governments. We used the emission factor equation given in AP-42 Section 13.2.1 (Paved Roads) for predicting particulate emissions of re-entrained road dust.

Exhibit 10 summarizes the criteria, HAP, and GHG emissions from the vehicle traffic associated with new development in the Eisenhower West area. New traffic associated with Alternatives A and B generated roughly 2-3 times more air pollution that Alternatives C and D, depending on the pollutant. Under Alternative C, there is no new office development or associated traffic. Alternative D is the transit oriented development alternative, which generates less traffic than Alternatives A and B.

**Exhibit 10 – Emission Estimates for Vehicle Traffic Associated with Redevelopment Alternatives**

| | Emissions (tons per yr) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Alternative** | **CO** | **NOx** | **PM-10** | **PM-2.5** | **SO2** | **VOC** | **Benzene** | **MTBE** | **CO2** |
| A - Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 | 0.2 | 0.2 | 4,548 |
| A - Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 | 0.4 | 0.5 | 11,020 |
| A - Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 | 0.1 | 0.1 | 1,954 |
| | **60.1** | **13.3** | **4.4** | **0.3** | **0.1** | **6.9** | **0.7** | **0.8** | **17,522** |
| B - Residential | 11.6 | 2.6 | 0.9 | 0.1 | 0.0 | 1.3 | 0.1 | 0.2 | 3,376 |
| B - Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 | 0.4 | 0.5 | 11,020 |
| B - Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 | 0.1 | 0.1 | 1,954 |
| | **56.1** | **12.4** | **4.1** | **0.3** | **0.1** | **6.5** | **0.7** | **0.7** | **16,350** |
| C - Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 | 0.2 | 0.2 | 4,548 |
| C - Office | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | - | - | - |
| C - Retail | 5.4 | 1.2 | 0.4 | 0.0 | 0.0 | 0.6 | 0.1 | 0.1 | 1,563 |
| | **21.0** | **4.6** | **1.5** | **0.1** | **0.0** | **2.4** | **0.2** | **0.3** | **6,111** |
| D - Residential | 12.2 | 2.7 | 0.9 | 0.1 | 0.02 | 1.4 | 0.1 | 0.2 | 3,570 |
| D - Office | 10.3 | 2.3 | 0.8 | 0.1 | 0.02 | 1.2 | 0.1 | 0.1 | 3,006 |
| D – Retail | 3.4 | 0.7 | 0.2 | 0.0 | 0.01 | 0.4 | 0.0 | 0.0 | 978 |
| | **25.9** | **5.7** | **1.9** | **0.1** | **0.05** | **3.0** | **0.3** | **0.3** | **7,554** |

## 6.3 Comparison of Emission Changes for Each Redevelopment Alternative

Exhibits 11 to 14 summarize the criteria air pollutant emissions for each alternative. The top half of the charts show the emissions after redevelopment for the industrial stationary sources, the industrial vehicle traffic, and the new vehicle traffic associated redevelopment. Alternatives A, B, and D show fairly similar net decreases in emissions due to the relocation of all four industrial sources. Alternative C shows less of a reduction since Covanta will continue to operate at its current location under this alternative. HAP and GHG emissions will have the same relative changes as for criteria emissions.

Beyond the immediate Eisenhower West area, emissions from industrial operations will increase in the Springfield area due to the relocation of the Virginia Paving, Vulcan Materials, and Norfolk Southern. Emissions from the truck traffic associated with these facilities will remain the same since they will be serving the same customer base from facilities only four miles from their current locations.

Since a suitable alternative disposing of solid waste at Covanta has not been identified, it is not possible to quantify the regional change in emissions from alternative waste disposal options. If the solid waste is transferred to another energy-from-waste facility, there would be no net change from the waste combustion process. However, there would be increased emissions from the truck traffic associated with the transfer the solid waste to another facility, perhaps as far away as 120 miles. This emission increase from truck traffic will be about 88 tons per year of NOx, 15 tons per year of PM2.5, and 16,000 tons per year of CO2.

**Exhibit 11 – Emission Estimates in the Study Area for Alternative A**

| | Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|
| | **CO** | **NOx** | **PM10** | **PM2.5** | **SO2** | **VOC** |
| **Emissions in West End Study Area After Redevelopment** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 |
| Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 |
| Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 |
| **Sub-Total** | **60.1** | **13.3** | **4.4** | **0.3** | **0.1** | **6.9** |
| **West End Total** | **60.1** | **13.3** | **4.4** | **0.3** | **0.1** | **6.9** |
| | | | | | | |
| **Net Change in Emissions in West End Study Area** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | -61.8 | -575 | -2.8 | -2.8 | -12.6 | -2.3 |
| Virginia Paving | -12.9 | -12.5 | -4.4 | -4.4 | -5.2 | -3.9 |
| Vulcan Materials | 0.0 | 0.0 | -0.3 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-74.7** | **-588** | **-7.6** | **-7.3** | **-17.8** | **-6.2** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | -0.3 | -1.2 | -1.3 | -0.2 | 0.0 | -0.1 |
| Virginia Paving | -0.6 | -2.3 | -2.5 | -0.4 | 0.0 | -0.1 |
| Vulcan Materials | -0.1 | -0.5 | -0.5 | -0.1 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | -0.1 | -0.2 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-1.0** | **-4.2** | **-4.5** | **-0.7** | **0.0** | **-0.2** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 |
| Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 |
| Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 |
| **Sub-Total** | **60.1** | **13.3** | **4.4** | **0.3** | **0.1** | **6.9** |
| **West End Total** | **-15.6** | **-579** | **-7.6** | **-7.6** | **-17.7** | **0.6** |

**Exhibit 12 – Emission Estimates in the Study Area for Alternative B**

| | Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|
| | **CO** | **NOx** | **PM10** | **PM2.5** | **SO2** | **VOC** |
| **Emissions in West End Study Area After Redevelopment** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 11.6 | 2.6 | 0.9 | 0.1 | 0.0 | 1.3 |
| Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 |
| Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 |
| **Sub-Total** | **56.1** | **12.4** | **4.1** | **0.3** | **0.1** | **6.5** |
| **West End Total** | **56.1** | **12.4** | **4.1** | **0.3** | **0.1** | **6.5** |
| | | | | | | |
| **Net Change in Emissions in West End Study Area** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | -61.8 | -575 | -2.8 | -2.8 | -12.6 | -2.3 |
| Virginia Paving | -12.9 | -12.5 | -4.4 | -4.4 | -5.2 | -3.9 |
| Vulcan Materials | 0.0 | 0.0 | -0.3 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-74.7** | **-588** | **-7.6** | **-7.3** | **-17.8** | **-6.2** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | -0.3 | -1.2 | -1.3 | -0.2 | 0.0 | -0.1 |
| Virginia Paving | -0.6 | -2.3 | -2.5 | -0.4 | 0.0 | -0.1 |
| Vulcan Materials | -0.1 | -0.5 | -0.5 | -0.1 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | -0.1 | -0.2 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-1.0** | **-4.2** | **-4.5** | **-0.7** | **0.0** | **-0.2** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 11.6 | 2.6 | 0.9 | 0.1 | 0.0 | 1.3 |
| Office | 37.8 | 8.4 | 2.8 | 0.2 | 0.1 | 4.3 |
| Retail | 6.7 | 1.5 | 0.5 | 0.0 | 0.0 | 0.8 |
| **Sub-Total** | **56.1** | **12.4** | **4.1** | **0.3** | **0.1** | **6.5** |
| **West End Total** | **-19.6** | **-579** | **-7.9** | **-7.7** | **-17.7** | **0.1** |

**Exhibit 13 – Emission Estimates in the Study Area for Alternative C**

| | Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|
| | **CO** | **NOx** | **PM10** | **PM2.5** | **SO2** | **VOC** |
| **Emissions in West End Study Area After Redevelopment** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | 61.8 | 575 | 2.8 | 2.8 | 12.6 | 2.3 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **61.8** | **575** | **2.8** | **2.8** | **12.6** | **2.3** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | 0.3 | 1.2 | 1.3 | 0.2 | 0.0 | 0.1 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.3** | **1.2** | **1.3** | **0.2** | **0.0** | **0.1** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 |
| Office | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Retail | 5.4 | 1.2 | 0.4 | 0.0 | 0.0 | 0.6 |
| **Sub-Total** | **21.0** | **4.6** | **1.5** | **0.1** | **0.0** | **2.4** |
| **West End Total** | **83.0** | **581** | **5.7** | **3.2** | **12.7** | **4.8** |
| | | | | | | |
| **Net Change in Emissions in West End Study Area** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | -12.9 | -12.5 | -4.4 | -4.4 | -5.2 | -3.9 |
| Vulcan Materials | 0.0 | 0.0 | -0.3 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-12.9** | **-12.5** | **-4.7** | **-4.4** | **-5.2** | **-3.9** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | -0.6 | -2.3 | -2.5 | -0.4 | 0.0 | -0.1 |
| Vulcan Materials | -0.1 | -0.5 | -0.5 | -0.1 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | -0.1 | -0.2 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-0.7** | **-3.0** | **-3.2** | **-0.5** | **0.0** | **-0.1** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 15.6 | 3.4 | 1.2 | 0.1 | 0.0 | 1.8 |
| Office | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Retail | 5.4 | 1.2 | 0.4 | 0.0 | 0.0 | 0.6 |
| **Sub-Total** | **21.0** | **4.6** | **1.5** | **0.1** | **0.0** | **2.4** |
| **West End Total** | **7.3** | **-10.8** | **-6.4** | **-4.8** | **-5.1** | **-1.6** |

**Exhibit 14 – Emission Estimates in the Study Area for Alternative D**

| | Emissions (tons/yr) | | | | | |
|---|---|---|---|---|---|---|
| | CO | NOx | PM10 | PM2.5 | SO2 | VOC |
| **Emissions in West End Study Area After Redevelopment** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Virginia Paving | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Vulcan Materials | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** | **0.0** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 12.2 | 2.7 | 0.9 | 0.1 | 0.0 | 1.4 |
| Office | 10.3 | 2.3 | 0.8 | 0.1 | 0.0 | 1.2 |
| Retail | 3.4 | 0.7 | 0.2 | 0.0 | 0.0 | 0.4 |
| **Sub-Total** | **25.9** | **5.7** | **1.9** | **0.1** | **0.0** | **3.0** |
| **West End Total** | **25.9** | **5.7** | **1.9** | **0.1** | **0.0** | **3.0** |
| | | | | | | |
| **Net Change in Emissions in West End Study Area** | | | | | | |
| **Industrial Stationary Sources** | | | | | | |
| Covanta | -61.8 | -575 | -2.8 | -2.8 | -12.6 | -2.3 |
| Virginia Paving | -12.9 | -12.5 | -4.4 | -4.4 | -5.2 | -3.9 |
| Vulcan Materials | 0.0 | 0.0 | -0.3 | 0.0 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-74.7** | **-588** | **-7.6** | **-7.3** | **-17.8** | **-6.2** |
| **Industrial Vehicle Traffic** | | | | | | |
| Covanta | -0.3 | -1.2 | -1.3 | -0.2 | 0.0 | -0.1 |
| Virginia Paving | -0.6 | -2.3 | -2.5 | -0.4 | 0.0 | -0.1 |
| Vulcan Materials | -0.1 | -0.5 | -0.5 | -0.1 | 0.0 | 0.0 |
| Norfolk Southern | 0.0 | -0.1 | -0.2 | 0.0 | 0.0 | 0.0 |
| **Sub-Total** | **-1.0** | **-4.2** | **-4.5** | **-0.7** | **0.0** | **-0.2** |
| **Vehicle Traffic from New Residential, Retail, Office** | | | | | | |
| Residential | 12.2 | 2.7 | 0.9 | 0.1 | 0.0 | 1.4 |
| Office | 10.3 | 2.3 | 0.8 | 0.1 | 0.0 | 1.2 |
| Retail | 3.4 | 0.7 | 0.2 | 0.0 | 0.0 | 0.4 |
| **Sub-Total** | **25.9** | **5.7** | **1.9** | **0.1** | **0.0** | **3.0** |
| **West End Total** | **-49.8** | **-586** | **-10.2** | **-7.8** | **-17.8** | **-3.4** |

## 7.0 Projected Ambient Air Quality for Each Alternative

It was beyond the scope of this study to perform a quantitative air quality modeling analysis or risk assessment of each alternative. Based upon the estimated changes in emissions under each alternative, a qualitative assessment of changes in air quality was made with the following conclusions:

**Alternative A.** Since all four industrial facilities will be relocated outside of the Eisenhower West area, emissions in the area will be reduced and air quality in the immediate area will show a small improvement. For example, recent air quality modeling of the Virginia Paving facility shows that its annual impact on PM10 air quality in Cameron Station is less that 1 µg/m3. In comparison, the annual PM10 concentration measured in Cameron Station during 2008 was 19 $\mu g/m^3$ and the NAAQS was 50 $\mu g/m^3$. Relocating the Virginia Paving facility will improve PM10 air quality in Cameron Station by about 5 percent. Similar improvements in PM 2.5 air quality are also expected. Since the emissions from Covanta are exhausted through a 210 foot stack, its emissions are widely dispersed and relocating Covanta would result in a very small improvement in PM10 in the Eisenhower West area. There would also be increased emissions from the truck traffic associated with the transfer the solid waste to another facility, perhaps as far away as 120 miles. The emissions associated with this new truck traffic would slightly degrade air quality in the northern Virginia region. Finally, the addition of new emissions from vehicle traffic associated with new residential, retail, and office space would result in a small degradation of air quality in the Eisenhower West area.

**Alternative B.** This alternative is similar to Alternative A, except that the Virginia Paving site would be redeveloped as a park. The air quality impacts of Alternative B are very similar to Alternative A.

**Alternative C.** Since Covanta remains at its current site under this alternative, the air quality improvements in the Eisenhower West area will not be as noticeable as under the other alternatives.

**Alternative D.** This alternative is similar to Alternative A, except the transit oriented redevelopment will occur which will result in less new vehicle traffic in the area. Since emissions from vehicle traffic associated with new development will be less, this Alternative is the best in terms of air quality impacts in the immediate Eisenhower West area.