## Introduction

This chapter details the assumptions and procedures used in the air quality conformity analysis for the *KYOVA 2040 Metropolitan Transportation Plan* and 2014-2017 Transportation Improvement Program. This analysis is required to meet the 1997 eight-hour ozone National Ambient Air Quality Standard (NAAQS). The KYOVA Metropolitan Area has a base year 2010 travel demand model with a horizon year of 2040 that was developed for the *KYOVA 2040 MTP* analysis. This air quality conformity analysis seeks to update the information contained in the *2035 Huntington-Ironton Area Transportation Study*. This analysis follows all the latest planning assumptions set forth by MAP-21 and applicable state and federal legislation, and included extensive coordination with the regional Interagency Consultation (IAC) group.

## Eight-Hour Ozone

The Huntington-Ashland area, comprising Cabell and Wayne Counties in West Virginia and Boyd County in Kentucky, was designated as non-attainment for the 1997 8-hour ozone standard in the April 25, 2004 Federal Register (69 FR 23857). The West Virginia portion of this area was reclassified to attainment on October 16, 2006 (71 FR 39618), while the Kentucky portion of this area was reclassified to attainment on September 4, 2007. As a provision of this attainment designation, the area is required to adhere to a maintenance plan that establishes motor vehicle emission budgets (MVEBs) for nitrogen oxide ($NO_x$) and volatile organic compounds (VOCs). The West Virginia and Kentucky portions of this area maintain separate MVEBs.

A revision to the 8-hour ozone standard was promulgated on March 27, 2008 (73 FR 16436). Under the 2008 8-hour ozone standard, the Huntington-Ashland area is designated as in attainment. However, the maintenance plan established under the 1997 standard implementation rules remains in effect until July 20, 2013.

Estimates of vehicle emissions are being compared against the budgets established in the area's maintenance plan to determine regional conformity for the ozone precursors. The SIP budget for the West Virginia portion of the Huntington-Ashland area was revised on September 15, 2011. The last year of the 8-hour SIP budget is 2018. Budgets represent emissions in tons per day during the summer months, as that season generates the most severe ozone precursor emissions. The MVEBs are contained in **Table 11.1**.

For the purposes of this analysis, the planning horizon years are 2018, 2020, 2030, and 2040. These years are consistent with the horizon years evaluated in the current travel demand model and represent the conformity years specified for analysis by the West Virginia Department of Environmental Protection (WVDEP) and the United States Environmental Protection Agency (EPA). The emission estimation methodology is consistent with that used to develop the federally approved MVEBs, with appropriate updates to reflect the planning assumptions developed as a part of the *KYOVA 2040 MTP*.

**Table 11.1 – 8-Hour Ozone Motor Vehicle Emission Budgets**

| Budget Year | Pollutants | |
|---|---|---|
| | NOx | VOC |
| **2009** | 14.0 tpd | 7.4 tpd |
| **2018** | 13.5 tpd | 6.6 tpd |

*Source: 76 FR 56975 (September 15, 2011)*

## Fine Particulate Matter (PM2.5), Annual Standard

The Huntington-Ashland area, consisting of Adams (partial), Gallia (partial), Lawrence, and Scioto Counties in Ohio, and Mason (partial), Wayne, and Cabell Counties in West Virginia, and Boyd County and a portion of Lawrence County in Kentucky, was designated as non-attainment for the annual $PM_{2.5}$ standard in 2005 (70 FR 944, 70 FR 19844). In late 2010, an analysis was begun to reassess the on-road generated $PM_{2.5}$ emissions. This analysis, completed in March 2011, resulted in a report titled *Mobile Source Emissions Inventory for Huntington-Ironton-Ashland $PM_{2.5}$ Nonattainment Area*. Based on this analysis, the EPA determined the entire Huntington-Ironton-

Ashland area had met the criteria for attainment (76 FR 55542, September 7, 2011). Recent rulings, 77 FR 76415 (December 28, 2012), 77 FR 75865 (December 26, 2012), and 76 FR 60492 (September 29, 2011), have formally redesignated the entire Huntington non-attainment area as an attainment area. Furthermore, these rulings find mobile source contributions to be insignificant to the overall $PM_{2.5}$ emissions in the area. As a result, no air quality conformity is needed for the 1997 $PM_{2.5}$ standard.

# Methodology

## Emissions Modeling

The EPA published a Federal Register notice[1] of availability on March 2, 2010, to approve MOVES2010 (Motor Vehicle Emissions Simulator), hereafter referred to as MOVES. Upon publication of the Federal Register notice, MOVES became the EPA's approved motor vehicle emission factor model for estimating VOCs, $NO_x$, CO, $PM_{10}$ and $PM_{2.5}$ and other pollutants and precursors from cars, trucks, motorcycles, and buses by state and local agencies. MOVES is a computer program designed by the EPA to estimate air pollution emissions from mobile sources. MOVES replaces EPA's previous emissions model for on-road mobile sources, MOBILE6.2. MOVES can be used to estimate exhaust and evaporative emissions as well as brake and tire wear emissions from all types of on-road vehicles.

An updated version of this software, MOVES2010b, was used for the purposes of this analysis. MOVES2010b is a minor update to MOVES2010. It includes general performance improvements from MOVES2010 and allows users to account for emissions under new car and light truck energy and greenhouse gas standards.

The Clean Air Act (CAA) requires the EPA to regularly update its mobile source emission models. The EPA continuously collects data and measures vehicle emissions to ensure the agency has the best understanding of mobile source emissions. This assessment, in turn, informs the development of the EPA's mobile source emission models. MOVES represents the agency's most up-to-date assessment of on-road mobile source emissions. MOVES also incorporates several changes to the EPA's approach to mobile source emission modeling based upon recommendations made to the agency by the National Academy of Sciences.

On March 2, 2010, the EPA and United States Department of Transportation (USDOT) established a two-year grace period before MOVES is required for new transportation conformity analyses. As a result, MOVES will be the required analysis platform for all conformity analyses after March 2, 2012. Although the air quality conformity analysis for the 2040 KYOVA MTP was conducted prior to this date, the MOVES2010b software was used to take advantage of the most current modeling tools available.

Parameters for this analysis were defined through the interagency consultation process and documented in the "2040 KYOVA Metropolitan Transportation Plan Air Quality Conformity Revised Protocol."

The MOVES software requires additional data not previously required in the MOBILE6.2 emissions modeling software. Values for source type population, vehicle age distribution, alternative vehicle fuel types, and meteorological data were obtained using local data. Default information was used for fuel supply and fuel formulation.

## Travel Demand Modeling

The KYOVA Travel Demand Model is the most recent and approved regional travel demand model for the study area. The travel demand model boundary includes all of Lawrence County in Ohio and Cabell and Wayne Counties in West Virginia. Model validation is a joint process between the MPO and the appropriate state review agencies. The KYOVA Travel Demand Model is a three-step model. Trip generation, trip distribution, and trip assignment components are included in the model. Mode choice is not an element. The current base year for the travel demand model is 2010.

1 http://www.regulations.gov/search/Regs/home.html#documentDetail?R=0900006480ab1f98

Socioeconomic data were forecasted to the year 2040 as a part of the *KYOVA 2040 MTP* development. The TransCAD modeling platform was used to develop this model. Model documentation has been prepared as a part of this effort to provide more information on the assumptions and methodology used to develop the Travel Demand Model.

### *Pre-Processing*

Information was gathered from the travel demand model to generate the average speed distribution, road type distribution, hourly vehicle miles traveled (VMT) distribution, Highway Performance Monitoring System (HPMS) vehicle type VMT, and ramp fraction. To streamline this process, a pre-processor was developed inside the Travel Demand Model. The pre-processor performed many of the calculations and disaggregations needed to produce MOVES-ready spreadsheets for each input. MOVES spreadsheet templates for each input type were developed for the identified model years. A script then was developed to pull the needed data from the model and perform any needed calculations. MOVES files generated through this exercise could then be applied directly in the County Data Manager.

### *Post-Processing*

The conformity analysis was performed using the emission rates method. As a result, post-processing of the data was required to arrive at the overall emissions output. To do this, the rate per distance and rate per vehicle output data were matched with the appropriate geographic area, analysis year, source types, pollutant types, road types, modeling hours, and speed classes. It then was aggregated with the corresponding source type population and vehicle miles traveled information. The resulting information was summarized by pollutant type for each full or partial county being analyzed to generate the overall emissions in tons per year. This post-processing exercise was developed as a script within the travel demand model platform.

## Modeling Parameters

The MOVES2010b developed and released by the EPA uses a graphical user interface with a set of input categories. A Runspec can be developed that stores the input values for these categories. The values and information included in the Runspecs developed for this analysis are explained in more detail in the following sections.

The emissions inventory development and emissions projection discussion below identifies procedures used by the KYOVA MPO to obtain emission rates for the 1997 8-hour non-attainment area.

**Table 11.2** summarizes the settings used in the MOVES run specification file. **Table 11.3** lists the assumptions used in the MOVES County Data Manager. Further details on the use of MOVES are found in the following sections.

### *MOVES Runspec*

#### Description

This input window is used to distinguish the individual Runspecs. For this analysis, the description is used to introduce the purpose for the analysis, the area being studied (i.e. Cabell and Wayne Counties), and the year of analysis (i.e. 2018, 2020, 2030, and 2040).

#### Scale

This input window is used to detail the information needed for the domain/scale of the analysis as well as the calculation type. The county level was selected as the domain for this effort, since it is the appropriate level for use in SIP and regional conformity analysis. The emission rate method was chosen for the calculation type. This calculation type was chosen following a discussion with the involved review agencies to determine the most appropriate calculation method for this analysis.

#### Time Spans

This input window has a variety of different timescale inputs for understanding the level of temporal aggregation being used in the analysis. The time aggregation level was specified as hours, based

on guidance from the EPA and Federal Highways Administration (FHWA) for the preferred aggregation level for SIP runs. Based on the interagency consultation process, the years 2018, 2020, 2030, and 2040 were chosen for the analysis years. 2018 is the budget year, 2020 and 2030 are interim years satisfying the requirement that analysis years be no more than 10 years apart, and 2040 is the plan horizon year. Each year was done within a different Runspec. Since the pollutant analysis being conducted is for the 1997 8-hour ozone standard, July was chosen to represent worst-case summertime conditions. Weekdays were selected as the representative day type since they are considered the worst-case type when compared with weekends. All hours of the day were included in the analysis to represent conditions over a full 24-hour period.

### Geographic Bounds

This input window asks for the name of the domain input database. To capture the overall effects of the emissions for the 1997 8-hour ozone non-attainment area, Cabell and Wayne Counties were analyzed as one custom domain. Four input databases were created during this process, reflecting the appropriate Runspec and analysis years.

### Vehicles/Equipment

This input window allows the user to specify fuel and vehicle types present within the transportation network. There are 13 vehicle classes (referred to as source use types) and five fuel types. This analysis considers diesel and gas fuel types only, in part to reflect the lack of compressed natural gas and liquefied petroleum gas vehicles in the population and to allow default fuel formulation and fuel supply information to be used in portions of the study area. Within these constraints, all possible vehicle and fuel types were considered. Diesel motorcycles, gas combination long-haul trucks, and gas intercity buses were removed since they are not represented in the vehicle population.

### Road Type

The MOVES software incorporates five different roadway types: off-network, rural restricted access, rural unrestricted access, urban restricted access, and urban unrestricted access. Expressways and freeways in the region are considered as restricted access facilities.

For this analysis, all five vehicle types were considered. Off-network emissions are intended to account for vehicle starts and evaporative emissions for parked vehicles. While these emissions are not captured through the information provided by the regional travel demand models, default values can be used to assess their impacts.

### Pollutants and Processes

This input window allows the user to specify different pollutants and processes desired for modeling. Since the purpose of this analysis is to assess emissions relating to the 8-hour ozone standard, the interagency consultation specified the inclusion of Oxides of Nitrogen ($NO_x$), Volatile Organic Compounds (VOC), Non-Methane Hydrocarbons (NMHC), and Total Gaseous Hydrocarbons (THC).

### Miscellaneous Strategies

The MOVES software includes input windows where provisions can be specified for specific strategies such as on-road retrofit and rate of progress emissions. Since these strategies are not being applied in this location, no information was entered for this section.

### Output

Output for the MOVES program is stored in a user-created database. Output databases were created for each of the four Runspec conditions. As specified in the interagency consultation process, grams, joules, and miles were used as the units of measure in the output database. Based on the parameters already established in these Runspecs, the time measurement for this analysis was set as hourly, and the location was automatically set for the link level. To assist with post-processing aggregation, it was further requested that the source use type information be included with the output.

### *County Data Manager*

Once all of the base parameters have been established for a given MOVES Runspec, the County Data Manager can be used to enter locally-specific data. Input provided in Excel spreadsheet format can be referenced using this tool, which converts the data to MySQL format and incorporates it into the MOVES analysis. For the KYOVA 1997 8-hour ozone non-attainment area, locally specific data could consist of data used for the entire region, statewide, or county-level data. The following sections detail these input criteria, and the methodology and assumptions used to arrive at the information entered for each.

#### Meteorology Data Importer

This importer requires the average temperature and relative humidity information for each hour of the day. To represent summertime conditions, meteorological data was collected for the month of July. ODOT supplied the information for West Virginia, obtained originally from NOAA data at the Huntington Tri-State Airport. Data from 2002 was used, gathered originally for the Mobile Source Emissions Inventory for Huntington-Ironton-Ashland PM2.5 Non-attainment Area. This data is assumed applicable for the entire non-attainment area and all analysis years.

#### Source Type Population Importer

This importer allows the user to enter vehicle population data for the local area, sorted by the 13 MOVES vehicle source types. The Protocol Report prepared for this analysis indicated that a combination of default data and local information would be used. The 0.8% annual growth factor established in the Protocol Report was used to determine future year source type population numbers. This information was gathered initially for the Mobile Source Emissions Inventory for Huntington-Ironton-Ashland PM2.5 Non-attainment Area and then adjusted to reflect the two-county area and modified analysis years.

WVDEP supplied the data for Cabell and Wayne Counties. This data was obtained from the West Virginia Division of Motor Vehicles (DMV) and cleaned to fit within the MOVES source types. An inventory of the bus population in the three-county area was used to modify the supplied DMV data. Due to questions about the validity or completeness of some of the data, default values were used for the following source types: 51 (Refuse Truck), 52 (Single Unit Short-Haul Truck), 53 (Single Unit Long-Haul Truck), 61 (Combination Short-Haul Truck), and 62 (Combination Long Haul Truck). Actual data has been used for Motorcycles, Passenger Cars, Passenger Trucks, Light Commercial Trucks, Transit Buses, School Buses, and Motor Homes. Data for source type 41 (Intercity Bus) was obtained by looking at the transit bus number and applying the ratio found in the MOVES default data between intercity and transit buses.

#### Age Distribution Importer

The Age Distribution Importer allows the user to provide vehicle age distribution data sorted by the MOVES vehicle source types. Vehicle age distribution is divided into 30 years based on vehicle model years. For each vehicle type, the sum of all age distributions will equal one. West Virginia data was provided by WVDEP, based on information from motor vehicle registration data. Data from 2010 was used to assess the age distribution of certain vehicle types. Based on the availability and confidence level about some of the vehicle class data, only certain types were distributed using local data. Cabell and Wayne County age distribution data was used for the following source types: source type 11 (Motorcycle), source type 21 (Passenger Car), source type 31 (Passenger Truck), source type 32 (Light Commercial Truck), and source type 54 (Motor Home). Age distribution data provided by ODOT was used for the remaining source types. As stated in the Protocol Report, the age distribution determined for each state was used for all analysis years. This information was gathered initially for the Mobile Source Emissions Inventory for Huntington-Ironton-Ashland PM2.5 Non-attainment Area, and was then adjusted to reflect the two-county area and modified analysis years.

#### Vehicle Type VMT and VMT Fractions

This data importer asks the user for the VMT in the study area by HPMS vehicle class type, hourly VMT

distributions, daily VMT distributions, and monthly VMT distributions. The HPMS vehicle class VMT is asked for an annual basis. To determine this information, data can be pulled from available travel demand models or from regional HPMS data.

### HPMS Vehicle Class VMT

The HPMS vehicle class VMT was determined using the pre-processor developed within the travel demand model. The travel demand model classifies vehicles into automobiles, single unit trucks, and combination unit trucks. The three vehicle classes in the model were divided into the six HPMS vehicle class types through the pre-processor. Since the travel demand model produces daily weekday volumes, the EPA conversion tool was used to convert these daily VMT numbers to annual values.

Following coordination with WVDEP, annual VMTs have been increased by 8% to account for seasonal variability in regional VMT. **Table 11.2** shows the HPMS vehicle class VMTs for each analysis year.

**Table 11.2 - HPMS Vehicle Type VMTs**

| HPMS Vehicle Class | HPMS ID | Annual Vehicle Miles Traveled | | | |
|---|---|---|---|---|---|
| | | 2018 | 2020 | 2030 | 2040 |
| Motorcydes | 10 | 8,395,119 | 8,541,761 | 9,223,101 | 10,073,723 |
| Passenger Cars | 20 | 1,069,644,772 | 1,088,328,820 | 1,175,140,125 | 1,283,520,244 |
| Other 2 axle-4 tire vehides | 30 | 254,518,689 | 258,964,500 | 279,620,984 | 305,409,701 |
| Buses | 40 | 11,888,401 | 12,233,066 | 13,855,709 | 15,755,339 |
| Single Unit Trucks | 50 | 64,515,206 | 66,385,611 | 75,191,262 | 85,500,054 |
| Combination Trucks | 60 | 44,479,068 | 45,813,424 | 52,311,950 | 60,188,508 |

### Daily VMT Fraction

The EPA conversion tool for Annual Average Weekday VMT was used to determine the daily VMT fraction for each analysis year.

### Monthly VMT Fraction

The EPA conversion tool for Annual Average Weekday VMT was used to determine the daily VMT fraction for each analysis year. Monthly VMT fractions are different on leap years (2020 and 2040) than on non-leap years (2018 and 2030).

### Hourly VMT Fraction

The hourly VMT fraction was determined using the pre-processor developed within the travel demand model. In order to produce the information needed for the MOVES input file, the three vehicle classes in the model had to be expanded to the 13 MOVES vehicle source types. In addition, the four time-of-day periods in the model had to be expanded to represent each hour of the day. The default mix of off-network hourly distribution percentages was used for all vehicle classes.

### Average Speed Distribution Importer

This importer gives the user the opportunity to enter locally specific average speed data, disaggregated by vehicle source type, road type, weekday/weekend, and hour of the day. The MOVES model uses 16 speed bins, dividing speed distributions into a fraction of driving within each speed bin for each of the criteria listed previously. The average speed distribution was determined using the pre-processor developed within the travel demand model. The vehicle classes in the model were expanded to the 13 MOVES vehicle source types, and the hourly distribution was expanded from the four time periods in the model to each hour of the day.

### Road Type Distribution Importer

This importer can be used to incorporate locally specific roadway distribution information. The average speed distribution was determined using the pre-processor developed within the travel demand model. The vehicle classes in the model were expanded to the 13 MOVES vehicle source types.

### Ramp Fraction Importer

This importer allows the user to input the percentage of traffic on urban restricted and rural

restricted roadways that is traveling on ramp facilities. The ramp fractions were determined using the pre-processor developed within the travel demand model.

#### Fuel Formulation and Fuel Supply Importer

These importers are used to input locally specific fuel properties into the model. The Protocol Report specified that default values would be used for this category.

#### Fueltype and Technologies Importer

This importer value considers the alternative vehicle fuels and technologies (AVFT). If no information is entered for AVFT, MOVES assumes a default mix of alternative fuels. There are currently no alternative fuel vehicles in the transit fleet for Cabell and Wayne Counties. While there is one electric vehicle charging station in Downtown Huntington, there is no available detail on the quantity of electric vehicles in the area. As a result, the default AVFT file was modified to exclude alternative fuel types. The modified file reflects only diesel and gasoline fuel types.

#### Inspection and Maintenance (I/M) Importer

This importer allows local inspection and maintenance data to be entered for the study area. The KYOVA region has no I/M program in place. When default data is exported for this, the file indicates no I/M programs in place for the area. Since this is an accurate representation of the I/M program in the area, no further data was entered.

## Post-Processing of MOVES Output

Once the appropriate data was input into the MOVES Runspecs and the County Data Manager, the four scenarios were run using the MOVES program. The following MOVES output databases were produced:

- KYOVA_2018
- KYOVA_2020
- KYOVA_2030
- KYOVA_2040

Since the emission rates method was used for this analysis, only two tables within each output database are used. The tables are called rateperdistance and ratepervehicle. Ultimately, information from both tables is used to determine overall emissions, aggregating the information for the running emissions (rateperdistance) and idling emissions (ratepervehicle).

The rateperdistance and ratepervehicle tables all represent scenarios for one geographic area (Cabell and Wayne Counties), one analysis year (2018, 2020, 2030, or 2040), one month (July), and one day type (weekdays). Results within the rateperdistance tables are disaggregated by hour of the day, pollutant type, process type, vehicle source type, roadway type, and speed category. Temperature and relative humidity data vary by the hour of the day. Results within the ratepervehicle tables are disaggregated by hour of the day, pollutant type, process type, and vehicle source type. Temperature data within these tables varies by the hour of the day.

The final output desired for this analysis summarizes the total emissions by pollutant type for each analysis year and geographic area. As a result, the information contained in each scenario's rateperdistance and ratepervehicle has to be matched with corresponding VMT and source population data. To do this, a set of supporting tables were created that match these criteria with information contained in the rateperdistance and ratepervehicle tables such as vehicle source types, road types, speed categories, and hour of the day. The creation of those tables and the process used to calculate total emissions are detailed in the subsequent sections.

### *Output Tables*

#### VMT and Source Type by County

This table displays the daily and annual VMTs and the source type population for all of the analysis years in this effort. The daily VMTs were pulled for each area from the spreadsheets used to develop the HPMS vehicle type VMTs. Annual VMTs for each county were determined using the EPA converter spreadsheet.

**Source Type Population Fraction and VMT Fraction**

This table separates the vehicle population into the different source types and determines the fraction of the population represented in each type as well as the fraction of total VMT represented in each type. The source type populations were pulled from the adjusted default data used for the MOVES runs. Within the MOVES format, VMTs were gathered by the six HPMS vehicle classes rather than the 13 MOVES source types. As a result, a translation was needed to match up the appropriate HPMS vehicle classes with the MOVES source types. Once the two classification types were matched to one another, the source type fractions established based on the vehicle populations were used to factor VMTs of different source type classifications that fell within the same HPMS vehicle class.

**Hourly Distribution Fractions**

This table provides the hourly VMT fractions, separated by source type, road type, hour of the day, and state. Hourly distribution fractions were pulled from the table created for use in the MOVES program.

**Road Type Distribution Fractions**

This table provides the road type VMT fractions separated by vehicle source types. Road type fractions were pulled directly from the MOVES input file developed earlier.

**Average Speed Distribution Fractions**

This table provides the average speed fraction sorted by source type, road type, hour of the day, and speed class. This file is the same as the MOVES input file used earlier in this analysis.

### *Aggregation Tables*

Once the supporting tables were created, the information within them needed to be combined in a way that matched the independent variables shown in the rateperdistance and ratepervehicle tables. Due to the large number of records and computations required to perform this exercise, an advanced database and/or scripting tool was necessary. Since the KYOVA Travel Demand Model is operated in the TransCAD platform, it was determined that a programming script developed and run in TransCAD would be an effective way to summarize this information.

To create a step within this scripting process that could later be referenced and checked, two intermediate tables were developed. The tables developed were designated as the VMT Summary Table and the Source Type Population Summary Table. Each table's intent and composition is described below.

**VMT Summary Table**

The VMT Summary Table contains many of the same independent variables found in the rateperdistance output tables—state, analysis year, source type, road type, hour of the day, and average speed bin. This table further divides the information by the individual counties in the analysis. The intent is to determine the proportion of daily and annual VMT for a given county and analysis year that is represented within each combination of vehicle source type, road type, hour of the day, and speed category. This table references the source type VMT fraction generated in the Source Type Population Fraction and VMT Fraction table, the road type VMT fraction generated in the Road Type Distribution table, the hour VMT fraction generated in the Hourly Distribution Fraction table, and the average speed fraction from the Average Speed Distribution Fraction table. These four values are multiplied together to determine an overall fraction, which is then multiplied by the corresponding daily and annual VMT established in the VMT and Source Type table. When the daily VMT proportions and annual VMT proportions are summed for a particular county and analysis year combination, they will equal the corresponding VMT values shown in the VMT and Source Type table.

**Source Type Population Summary Table**

The Source Type Population Summary Table contains many of the same independent variables found in the ratepervehicle output tables; namely, state, analysis year, source type, road type, and hour of the day. This table further divides the information by the individual counties in the

analysis. The intent of this table is to determine the proportion of the source type population for a given county and analysis year that is represented within each combination of vehicle source type and hour of the day. Since this is intended to represent idling conditions, only off-network roadway type was considered for the source type population summary. This table references the source type population fraction generated in the Source Type Population and VMT Fraction table and the hour VMT fraction generated in the Hourly Distribution Fractions table. These two values are multiplied together to get an overall fraction, which is then multiplied by the corresponding source type population information found in the VMT and Source Type table. The population proportion should be equal to the corresponding source type population value shown in the VMT and Source Type table.

## Results Summary

As mentioned in the previous section, a TransCAD script was developed to quickly match the information in the rateperdistance and ratepervehicle tables with corresponding VMT and source type population information. This script also summed the matched information by county, analysis year, and pollutant type to create the final output format needed for this process. Results from this script are produced in a form that is easily formatted to show the overall emissions information contained in the main body of this report.

The results of this analysis and summary for the 1997 8-hour ozone standard, shown in **Table 11.3**, indicate that the future area-wide mobile source emissions of the ozone precursors NOx and VOC for an average summer day will be less than the emissions budgeted in the maintenance plan.

The results indicate a steady decline in NOx and VOC emissions in future analysis years. The one exception to this is a slight increase in VOCs in 2040. This can be attributed to the fact that overall improvements in the vehicle fleet are anticipated to taper off after 2030.

As demonstrated in the preceding analysis, the projected mobile source emissions for VOC and NOx will be less than the allotted budget through the year 2040. Therefore, the *KYOVA 2040 MTP* and the corresponding 2014-2017 Transportation Improvement Program conform to the 1997 8-hour ozone NAAQS.

**Table 11.3 – Projected $NO_x$ and VOC Emissions**

| Year | NOx (tons/day) | | VOC (tons/day) | |
|---|---|---|---|---|
| | Budget | Modeled | Budget | Modeled |
| **2018** | 13.5 | 2.76 | 6.6 | 0.79 |
| **2020** | 13.5 | 2.29 | 6.6 | 0.68 |
| **2030** | 13.5 | 1.43 | 6.6 | 0.53 |
| **2040** | 13.5 | 1.38 | 6.6 | 0.55 |

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