



# PROJECT-LEVEL AIR QUALITY ANALYSIS RESOURCE DOCUMENT

Prepared for:  
**VDOT Environmental Division**

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# Project-Level Air Quality Analysis Resource Document

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# Project-Level Air Quality Analysis Resource Document

## 1. INTRODUCTION

### 1.1 ROLE AND COVERAGE

This Resource Document<sup>1,2</sup> was created by the Virginia Department of Transportation (VDOT, or the Department) to facilitate and streamline the preparation of project-level air quality analyses. It is intended as a resource for modelers to help ensure that not only regulatory requirements and (as appropriate) guidance are met in all analyses but also high quality standards for modeling and documentation are consistently achieved. It addresses in a comprehensive fashion the models, methods and assumptions (including data and data sources) needed for the preparation of air quality analyses for transportation projects by or on behalf of the Department. It includes an associated online data repository to support project-level modeling.

Air quality analyses for transportation projects are typically conducted to support environmental clearance documents that are being prepared pursuant to the National Environmental Policy Act (NEPA) and therefore developed following guidance provided by the US Department of Transportation (US DOT). However, additional and more detailed requirements and guidance for modeling, analysis and consultation also apply for projects located in areas subject to the federal transportation conformity rule (40 CFR Parts 51 and 93), which was issued by the US Environmental Protection Agency (US EPA) pursuant to the federal Clean Air Act as amended, and the corresponding Virginia *Regulation for Transportation Conformity* (9 VAC 5-151). References and links to key regulations and guidance documents are provided in **Appendix B-1**.

At the time of preparation of this document, the following areas or jurisdictions in Virginia are subject to these additional (EPA transportation conformity) requirements for project-level air quality analyses:

- Northern Virginia<sup>3,4</sup>, i.e., the Virginia portion of the DC-MD-VA maintenance area for the 1997 annual National Ambient Air Quality Standard (NAAQS) for fine particulate matter (that under 2.5 microns in diameter, or PM<sub>2.5</sub>).

<sup>1</sup> The Resource Document and associated data repository (files and links) are available via VDOT Environmental website: <http://www.virginiadot.org/programs/pr-environmental.asp>

<sup>2</sup> The Resource Document complements the Department “*Scoping Guidelines for Project-Level Air Quality Analyses*”, which provides guidance on developing a scope of work for an analysis, and “*Template Report for Project-Level Air Quality Analyses*”, which provides a template report for NEPA documentation for air quality. Both of these documents are posted on the Department website with the Resource Document.

<sup>3</sup> As specified on the US EPA Green Book web page (<http://www.epa.gov/airquality/greenbook/>) for the NAAQS for PM<sub>2.5</sub>. It currently lists the following jurisdictions in Virginia as part of the DC-MD-VA maintenance area for the 1997 annual PM<sub>2.5</sub> NAAQS: Alexandria, Arlington County, Fairfax, Fairfax County, Falls Church, Loudoun County, Manassas, Manassas Park, and Prince William County.

<sup>4</sup> At the time of preparation of this document, EPA is proposing with its draft implementation rule for the 2012 PM<sub>2.5</sub> NAAQS to revoke the 1997 primary NAAQS. Since that is the NAAQS for which the northern Virginia area is currently in maintenance for PM, project-level air quality analyses for conformity purposes for PM<sub>2.5</sub> will no longer be required for that area assuming the revocation is finalized as proposed. (See: <http://www.epa.gov/pm/actions.html>.) References in this Resource Document and the associated online data

- Alexandria and Arlington County, which are currently in maintenance for the NAAQS for carbon monoxide (CO)<sup>5,6</sup>.

In areas that are nonattainment or maintenance for ozone, non-exempt federal projects require a regional conformity determination, but there are no project-level analysis requirements. The Washington, DC-MD-VA region is currently in nonattainment for the 2008 NAAQS ozone standard.

All other areas in Virginia are subject only to NEPA, and not to transportation conformity for project-level air quality analyses.

## 1.2 CONSULTATION ON RESOURCE DOCUMENT

Inter-agency consultation on models, methods and assumptions to be applied in conformity analyses is a requirement of the federal transportation conformity rule (40 CFR 93.105(c)(1)), and these requirements are reflected in the corresponding Virginia regulation (9 VAC 5-151 Section 70). This inter-agency consultation for conformity purposes (IACC) is additional to the consultation conducted for purposes of NEPA. The requisite IACC was conducted on the models, methods and assumptions presented or identified in this Resource Document (including the associated online data repository) for the areas or jurisdictions currently subject to conformity requirements for project-level (hot-spot) analyses. A summary of the process and outcomes of the IACC conducted is provided in **Appendix A**.

Exhibit 1.2.1 presents standard text (including an associated footnote) that serves to document the IACC conducted on the models, methods and assumptions applied in an analysis. This text or a similar statement (as appropriate to the analysis) is included in the documentation for each project-level air quality analysis conducted by or on behalf of the Department.

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repository to modeling PM<sub>2.5</sub> for conformity purposes should not be interpreted to mean such analyses will continue to be conducted in the absence of a specific regulatory requirement to do so.

<sup>5</sup> As specified on the US EPA Green Book web page for the NAAQS for carbon monoxide: <http://www.epa.gov/airquality/greenbook/cindex.html>.

<sup>6</sup> The maintenance status for CO for this area will expire March 16, 2016, at which time the associated conformity requirements (including those related to project-level air quality analyses) will no longer apply. Excerpt from the Metropolitan Washington Council of Government's website (<http://www.mwcog.org/environment/air/CO/default.asp>): *"The metropolitan Washington area has been meeting federal standards for carbon monoxide (CO), one of six ambient pollutants regulated by the Clean Air Act (CAA), since March 1996. The Clean Air Act requires states to submit two 10-year maintenance plans demonstrating that the region will continue to maintain the eight-hour CO standard. The first Carbon Monoxide Maintenance Plan covered 10 years after redesignation, from 1996-2007. The region was required to revise the Maintenance Plan eight years after redesignation, in this case, March 2004. The Revised Carbon Monoxide Maintenance Plan covers the period from 2007-2016. It demonstrates, using current CO data and projections that the Washington region will continue to meet this standard for that period."* References in this Resource Document and the associated online data repository to modeling CO for conformity purposes should not be interpreted to mean such analyses will continue to be conducted in the absence of a specific regulatory requirement to do so.

**Exhibit 1.2.1 Standard IACC Reference Text for Project-Level Documentation**

*As the project is located in an area subject to the federal transportation conformity rule (40 CFR Parts 51 and 93), inter-agency consultation was required by the federal rule (40 CFR 93.105(c)(1)) and the corresponding section of the Virginia Regulation for Transportation Conformity (9 VAC 5-151 Section 70). This consultation was conducted on the models, methods and assumptions specified in the VDOT Project-Level Air Quality Analysis Resource Document (see: <http://www.virginia.gov/programs/pr-environmental.asp>), which were applied in this analysis either directly or without substantive change (see footnote). The Resource Document was created by VDOT to facilitate and streamline the preparation of project-level air quality analyses while maintaining high standards for quality.*

*Inter-agency consultation for conformity purposes was conducted on the VDOT Resource Document on December 14th, 2015. Federal, state and local agencies, including the following, were invited to participate as required by the federal and Virginia conformity regulations:*

- *FHWA Virginia Division and Resource Center;*
- *Virginia Department of Environmental Quality;*
- *Virginia Department of Transportation;*
- *Virginia Department of Rail and Public Transit;*
- *Metropolitan Washington Council of Governments;*
- *EPA Region 3;*
- *Local agencies*

*All comments received on the VDOT Resource Document in the consultation process were considered as appropriate before the models, methods and assumptions (including data and data sources) and the definition of substantive change as provided in the VDOT Resource Document were finalized. No adverse comments were received. A summary of the consultation process, including a list of all individuals and agencies invited to participate, can be found in Appendix A of the VDOT Resource Document.*

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***Footnote:** Note the following definition of “substantive change” was included in the Resource Document and made the subject of inter-agency consultation: “For project-level air quality analyses conducted to meet conformity requirements and/or for purposes of NEPA, a substantive change is defined here as one that would reasonably be expected to affect the modeling results and/or the analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared. For analyses involving project-specific dispersion modeling for any pollutant(s) for conformity purposes, this includes whether the project would pass the applicable conformity test(s).”*

Similarly, Exhibit 1.2.2 presents standard text typically included with project-level documentation for any analyses involving IACC over and above that previously conducted on the Resource Document. The statement (or a similar statement as appropriate to the analysis) is included following the text from Exhibit 1.2.1. It should also identify the motivating factor(s) for conducting the additional IACC, e.g., the project involves an EIS, is high profile and/or is considered relatively complex.

**Exhibit 1.2.2 Standard Text for Additional IACC**

*For this analysis, and notwithstanding the inter-agency consultation already conducted on the Resource Document as referenced above, additional inter-agency consultation was conducted on <dates> involving the same agency stakeholders as noted above. The additional consultation was conducted for this project:*

- *<as the air quality analysis for this project is being developed in support of an Environmental Impact Statement, the project may be considered one of greater interest to the public and other stakeholders, and/or the project may be considered relatively complex, for which the Department at its discretion provides additional opportunities for public and inter-agency stakeholder review and comment in the interests of greater transparency.>*
- *<as the proposed analysis involves the application of specific <models>, <methods> and/or <assumptions> that are or may be substantively different from those specified in the Resource Document, but are considered appropriate for this project for the following reason(s): ...<Specify or list>. Otherwise, the models, methods and assumptions applied in the analysis were applied as specified in the Resource Document.> <and/or>*
- *<for transparency, as the applicable <models>, <methods> and/or <assumptions> as specified in federal regulations and guidance have changed since the issuance or last update of the Resource Document (which incorporates all such updates automatically) but have not been explicitly incorporated into an updated version or revised Resource Document and/or the associated website or files.>*

*All comments received in this additional inter-agency consultation were considered as appropriate before the models, methods and assumptions (including data and data sources) for the project analysis were finalized. A summary of the additional or project-specific consultation and results is also provided in Appendix <specify> of this analysis.*

**1.3 DEFINITION OF SUBSTANTIVE CHANGE**

For project-level air quality analyses conducted to meet conformity requirements and/or for purposes of NEPA, a *substantive change* is defined here as one that would significantly affect the modeling results and/or the analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared. For analyses involving project-specific dispersion modeling for any pollutant(s) for conformity purposes, this includes whether the project would pass the applicable conformity test(s).<sup>7</sup>

<sup>7</sup> Note federal requirements for determining the frequency of air quality conformity determinations are not intended to be affected by the proposed definition for substantive changes. Specifically, 40 CFR 93.104(d) requires a redetermination of conformity (for any FHWA/FTA project) "if one of the following occurs: a significant change in the project's design concept and scope; three years elapse since the most recent major step to advance the project; or initiation of a supplemental environmental document for air quality purposes". Major steps include NEPA process completion; start of final design; acquisition of a significant portion of the right-of-way; and, construction (including Federal approval of plans, specifications and estimates).

## 2. GENERAL PROTOCOLS

The Department has established the following general protocols that apply for all project-level air quality analyses conducted by or on behalf of the Department. As a general protocol, the Department is the final arbiter on all aspects of project-level air quality analyses including the application of the protocols.

### 2.1 LATEST REGULATIONS AND GUIDANCE

#### *2.1.1 Regulations and Guidance in Effect at the Time a Project is Initiated*

Each project-level analysis is conducted to meet all applicable regulatory requirements and be consistent, as appropriate, with guidance that are in effect (following any applicable grace period) at the time that the analysis is initiated. This includes but is not limited to the specification of models, methods and assumptions to be applied for project-level air quality analyses as well as administrative, documentation and process requirements. **Appendix B1** provides links to available regulations and guidance pertinent to the project-level analysis process at the date of this document.

#### *2.1.2 Process for Responding to Deficiencies Identified in Models, Regulations and Guidance*

In the event that the applicable federal models and/or associated requirements and guidance, which are subject to ongoing or periodic revisions or updates by the US EPA and/or US DOT, are discovered to have a deficiency or deficiencies that would affect the modeling or analysis for a project or category of projects to the degree that it may have a substantive effect on its results, the Department will notify the US DOT, EPA and others as appropriate of the identified issue(s) and work with them as appropriate to a resolution.

### 2.2 INITIATING A PROJECT-LEVEL AIR QUALITY ANALYSIS

#### *2.2.1 Project Sponsor Responsibility*

It is the responsibility of the project sponsor to ensure that a project level analysis is initiated as required under the NEPA and/or conformity regulations. The Department and appropriate staff should be sought out for consultation as early in the process as possible for any items that depart from the methods and data identified in this Resource Document.

#### *2.2.2 Initiating a Project within a Grace Period*

With respect to determining whether an air quality analysis for a project has been initiated before, within or after a specified grace period, which may be provided for example by EPA and/or FHWA/FTA following a change in applicable regulation and/or guidance, with a model update, or other reason, a project-level air quality analysis is considered to have been initiated typically as of the earliest date of the occurrence of one or more of the following:

1. A task to conduct a study has been assigned (typically by Department intranet and/or email),
2. Traffic data and/or forecasts as needed for the air quality analysis have been requested for the project or otherwise confirmed to be in development,

3. Design information as needed for the air quality analysis has been requested for the project or otherwise confirmed to be in development,
4. Development and/or documentation of project-specific information for the air quality analysis has been initiated,
5. Modeling for the air quality analysis for the project has been initiated, and/or
6. Other reasonable step(s) have been taken to initiate the air quality study.

The date the analysis started should be documented in the project file.

## 2.3 UPDATES TO PROJECT-LEVEL AIR QUALITY ANALYSES

This section provides criteria typically used for determining when updates or revisions are made to project-level analyses.

### 2.3.1 Completed Project Analyses

For project-level air quality analyses previously completed, updates or revisions to the modeling, analysis and/or documentation are not typically conducted unless both:

1. the overall NEPA document is being re-evaluated or supplemented for air quality reasons, in which case the US DOT (in consultation with Department air quality staff as appropriate) may request an update,  
*and*
2. a review by Department air quality staff (in consultation with FHWA, as appropriate) concludes that a new or revised analysis is warranted as changes in the models, methods and/or assumptions from the original analysis would be considered substantive by the definition provided in this document.

### 2.3.2 Completed Project Analyses Pending Submission or Approval

For project-level air quality analyses completed but pending submission or approval, updates or revisions to the modeling, analysis and/or documentation are not typically conducted unless:

1. a review by Department air quality staff (in consultation with FHWA, as appropriate) concludes that a new or revised analysis is warranted as changes in the models, methods and/or assumptions from the completed analysis would be considered substantive by the definition provided in this document,  
or
2. the Department at its discretion decides to incorporate the changes, recognizing the potential added time and cost for the updates and/or revisions.

### 2.3.3 Project Analyses Underway

For project-level air quality analyses underway (initiated with modeling conducted in whole or in part), updates or revisions to the models, methods and assumptions once finalized for the analysis are not typically incorporated unless:

1. a review by Department air quality staff (in consultation with FHWA, as appropriate) concludes that a new or revised analysis is warranted as changes in the models, methods and/or assumptions from the analysis underway would be considered substantive by the definition provided in this document,  
or
2. the Department at its discretion decides to incorporate the changes, recognizing the potential added time and cost for the updates and/or revisions.

#### **2.3.4 Criteria for Additional or Project-Specific IACC**

If an update or revision is being conducted or planned for a project subject to conformity requirements, then additional or project-specific inter-agency consultation is typically:

1. conducted only for changes that are substantively different from both the original analysis and current Resource Document,  
and
2. not conducted otherwise.

In the latter case, the updated analysis would be similar to a new study being conducted based on the models, methods and assumptions/data presented in the Resource Document (as there would be no need for additional or project-specific IACC over and above that already conducted for the Resource Document.) The project documentation for the updated analysis would therefore simply include appropriate reference to the Resource Document and the inter-agency consultation conducted on the models, methods and assumptions presented or referenced therein.

## **2.4 PROCESS IMPROVEMENT**

### **2.4.1 New and/or Improved Processes and Procedures**

The Department at its discretion may implement new and improved processes and procedures for project-level air quality analyses, in keeping with its objectives for streamlining and otherwise improving environmental clearance processes.

### **2.4.2 Best or Improved Practices**

The Department may implement best practices or improved practices as may be recommended by the US DOT, EPA and/or the American Association of State Highway and Transportation Officials (AASHTO), or that it develops itself.

### **2.4.3 Applied Research**

The Department may implement recommendations for new or improved processes and procedures based on research that is cited by the US DOT or EPA in applicable regulations and guidance, and/or conducted by the Department, which may be done in consultation and cooperation with the US DOT, EPA, Virginia Department of Environmental Quality (VDEQ) and/or others as appropriate.

### **2.4.4 Inter-Agency Consultation**

Inter-agency consultation on process and procedural improvements may be limited to changes identified by the Department as substantive and not generally conducted otherwise.

## **2.5 STREAMLINING**

### **2.5.1 Streamlining Objective**

Analyses are streamlined to the extent feasible and appropriate for the project type and context (i.e., level of environmental document, level of public and stakeholder interest, and complexity), while meeting all regulatory requirements and maintaining consistency, as appropriate, with guidance.

### **2.5.2 Analyses in Excess of Regulatory Requirements Not Typically Conducted**

Analyses in excess of regulatory requirements (including but not limited to those related to scope, applicability, and tests as well as related administrative, documentation and/or process requirements) are not conducted except at the discretion of the Department.

### **2.5.3 Applications of Section 2.5.2 Protocol**

Specific applications of this protocol include but are not limited to the following:

#### **2.5.3.1 Projects for Analysis**

Modeling or analyses (qualitative or quantitative) are only conducted for projects that change (add, delete, relocate or otherwise modify) roadway capacity, intermodal facilities, and/or transit service in areas with significant traffic volume. For areas where transportation conformity applies, current regulations are used to determine whether projects require a quantitative analysis<sup>8</sup>.

#### **2.5.3.2 Pollutants**

Pollutants to be modeled are limited to those specified by regulation and consistent with available guidance, as appropriate.

#### **2.5.3.3 Project Area and Affected Facilities**

##### **2.5.3.3.1 General Limitation**

The project area, including the determination of the number and extent of affected facilities (as appropriate), to be included in modeling for an air quality analysis is generally limited to the minimum needed to meet regulatory requirements and maintain consistency as appropriate with guidance.

##### **2.5.3.3.2 Roadway Projects**

For roadway projects, emission modeling (and, if applicable, dispersion modeling) is typically limited to:

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<sup>8</sup> See 40 CFR 93.123 for procedures for determining localized CO, PM10, and PM2.5 concentrations (hot-spot - analysis) <http://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol21/xml/CFR-2013-title40-vol21-sec93-123.xml>.

1. the specific facility or facilities being improved that are the subject of the NEPA document (or specific locations within the area of the proposed improvements), or
2. those facilities plus any affected facilities identified following the process outlined in the next paragraph and generally comprised of roadways that are contiguous and/or adjacent to the planned improvements (and generally do not include facilities that are not contiguous or adjacent unless a clear technical basis is provided for their inclusion).

#### **2.5.3.3 Affected Facilities**

The determination of which facilities (if any) are to be considered affected by the proposed improvements is typically made by an assessment against technical criteria, which may include but are not necessarily limited to:

1. Forecast changes in traffic volumes, speeds or composition (primarily truck and bus percent), which may follow recommendations as available and appropriate from transportation planning and traffic engineering staff based on their review of available traffic and activity data and forecasts.
2. Proximity to sensitive receptors (if any).

### **2.5.4 Modeling Tests and Number of Runs**

#### **2.5.4.1 General Limitation**

Both modeling tests and the number of model runs are limited to those specified in regulation and maintain consistency as appropriate with guidance.

#### **2.5.4.2 Optional Runs**

Optional or additional runs (i.e., those in excess of the minimum required) are typically not conducted or made part of NEPA documentation except at the discretion of the Department. Examples of optional runs include (but are not limited to):

- Comparisons of results from different models/modeling options, model inputs (e.g., sensitivity analyses), or growth scenarios (e.g., alternative scenarios to that applied in the development of the official traffic and activity forecasts for the project);
- Testing of various models and model options (traffic, emission or dispersion); or
- Modeling for pollutants not required by regulation.

#### **2.5.4.3 Department Decision on Optional Runs**

The Department makes the final decision on which models and model options to run. The Department may receive comments from other parties on the model(s) and/or option(s) to run, but the final decision(s) rest(s) with the Department. For example, while three dispersion modeling options are currently available for PM analyses (CAL3QHCR, AERMOD area sources, and AERMOD volume sources), only one will typically be run for a project. The final decision on the model and option to run will be made by the Department.

## 2.5.5 Screening and Worst-Case Analyses

### 2.5.5.1 General Provision

Screening and worst-case analyses may be conducted at the discretion of the Department in which conservative or worst-case assumptions are applied in order to streamline the modeling and analysis process and at the same time provide a relatively higher level of confidence that the NAAQS will not be exceeded. Such analyses meet all applicable regulatory requirements and maintain consistency, as appropriate, with guidance<sup>9</sup>.

### 2.5.5.2 Conservative and Worst-Case Assumptions

Assumptions of a conservative nature (tending to overestimate activity, emissions, and/or concentrations) including worst-case assumptions may include but not be limited to traffic and activity data forecasts, design features, emission model inputs, and dispersion model inputs.

### 2.5.5.3 Exceptions

At the discretion of the Department, and subject to resource constraints, more refined approaches involving additional and/or more detailed analyses may be considered on a project by project basis.

## 2.5.6 Interface and Utility Software

### 2.5.6.1 General Provision

The Department at its discretion may apply interface and utility software to facilitate and streamline the modeling process, which may invoke or run official emission, dispersion and related utility software or models.

Interface software can help streamline the file preparation and modeling process, ensure appropriate default data are entered (resulting in improved quality assurance and control) and, by providing standard exhibits (tables and graphics) of modeling results that may be included in project reports, help support transparency in documentation.

Utility software may also be applied to facilitate the processing of input data and modeling results. GIS software for example may be applied to facilitate data analysis and presentation.

## 2.6 TRAFFIC

### 2.6.1 Guidance and Procedures

Traffic and activity data and forecasts for project-level air quality analyses typically are generated based on federal and Department guidance and procedures as available and as applicable, both of which may be updated periodically.

### 2.6.2 Data Sources

Data are typically derived from a variety of sources, including but not limited to the VDOT ENTRADA system, Highway Capacity Manual calculations, travel demand forecasting models, traffic simulation

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<sup>9</sup> At the time of preparation of this document, standard or federal screening protocols applicable to PM hot spot analyses have yet to be developed or implemented.

models and/or other planning analysis methods as available and appropriate for the project. Available data on existing and forecast transit ridership and bus operations are also typically considered in the development of traffic forecasts. Travel demand model output may be adjusted as appropriate using accepted post processing procedures before application in project-level analyses.

### **2.6.3 Transportation Planning and Engineering Staff Responsible for Traffic and Activity Data and Forecasts**

#### **2.6.3.1 Traffic and Activity Data Preparation by Traffic Engineering and/or Transportation Planning Staff**

Traffic and activity data are prepared or specified by appropriate traffic engineering and transportation planning staff (see Appendix D for details on data needs for analyses). Traffic and activity data and forecasts are critical inputs for project-level air quality analyses, and accordingly are to be generated by staff with the appropriate training and experience for that task. Conversely, staff that do not have the appropriate training and experience are not to prepare, update or otherwise modify traffic and activity forecasts.

#### **2.6.3.2 Exceptions**

Exceptions are made as reasonable and appropriate, e.g. for assembling readily-available data including but not limited to posted speeds, VDOT Traffic Monitoring System/ Highway Performance Monitoring System (HPMS) data, and/or published reports that present data and forecasts including, but not limited to, the traffic and related data assembled for the periodic emission inventory.

### **2.6.4 Streamlining**

#### **2.6.4.1 Lowest Cost and Simplest Options Typically Selected**

For purposes of streamlining analyses, and recognizing limitations in the current state of the art in transportation modeling for project-level air quality analyses, the lowest cost and most straightforward option for generating traffic and activity data and forecasts will typically be applied for each analysis.

#### **2.6.4.2 Modeling for Typical Highway Projects**

For highway projects, streamlining typically means:

1. The default approach for traffic input to the emission model is that based on average speeds.
2. More complex approaches for traffic inputs for emission modeling (including link drive schedules and/or operating mode distributions) are not typically applied. They may be applied as appropriate data and forecasts are available.

Traffic microsimulation and/or mesoscopic modeling approaches are typically not applied due to the time and cost for their preparation (which can be significant) and to limitations in the state of practice for such modeling. In cases where traffic microsimulation and/or mesoscopic modeling has been undertaken or is already planned in order to support the traffic analysis of a roadway project, such efforts may be used to inform the project air quality analysis in whole or in part. However, the application of microsimulation and/or mesoscopic modeling results for project level air quality

purposes is an evolving field of study and recommended practices do not currently exist. The need to conduct a project level air quality analysis is therefore not by itself typically justification for the time and cost of developing microsimulation and/or mesoscopic analyses for a planned roadway project.

#### **2.6.4.3 Modeling for Complex Projects**

For more complex projects, and/or projects of greater stakeholder interest, and where resources are available, more refined approaches for generating traffic and activity data and forecasts may be applied. This includes the specification or generation of link drive schedules and/or operating mode distributions for input to the emission model. As the state of the practice evolves and costs are reduced, the potential for more routine application of more refined approaches for generating traffic and activity data and forecasts may increase.

## **2.7 ROADWAY GRADE**

Federal guidance is not yet available on the preferred or optimal level of detail to include in model inputs for roadway grades. In the interim, i.e., in the absence of specific federal guidance or additional research to inform the determination of roadway grades, the following protocols apply:

### **2.7.1 Threshold Magnitude for Modeling Changes in Roadway Grades**

The threshold magnitude for modeling changes in roadway grade for a project-level air quality analysis prepared by or for the Department is between 2 and 5%. The minimum value of 2% is based on the definition of “Level Terrain” contained within in the *Highway Capacity Manual (HCM) 2010 edition*<sup>10</sup>. The maximum value of 5% is based on AASHTO’s *A Policy on Geometric Design of Highways and Streets*, 2011, which indicates that auto speeds are not significantly impacted at higher grades<sup>11</sup>. For each direction of travel, specific threshold values will be determined based on an evaluation of truck volumes, length of grade and engineering judgment. Typical values are as follows:

- The default threshold value is 2%
- If trucks are not a significant portion of the total traffic volume (e.g. less than 5%), then a threshold grade of 5% would be appropriate for the analysis.
- If trucks are a significant portion of the total traffic volume (e.g. greater than or equal to 5%), then a threshold grade of 2-4% would be appropriate for the analysis. Exact values would be determined considering the level of truck activity and engineering judgment.

### **2.7.2 Relatively Flat Roadways**

For roadway segments with average grades and grade changes of a magnitude less than or equal to the threshold specified above, the roadway segments may be coded as flat or level (i.e., 0% roadway grade) or at the average grade.

<sup>10</sup> *Highway Capacity Manual 2010 (HCM2010) fifth edition*, Chapter 9 (pages 9-11)

<sup>11</sup> AASHTO, “*A Policy on Geometric Design of Highways and Streets*”, 2011. See the discussion on roadway grades on pages 235-247.

### **2.7.3 Roadways with Grades and/or Changes in Grades above the Threshold**

For roadway segments with average grades and/or grade changes of a magnitude greater than the threshold specified above:

1. Each segment may be coded as the average grade for that segment.
2. For greater resolution, separate segments may be coded to the extent appropriate and feasible where the magnitude of the change in grade is greater than or equal to the threshold.

### **2.7.4 Refined Analyses**

At the discretion of the Department, more refined analyses may be conducted using more detailed roadway grade data than indicated by the threshold specified above. The Department makes the final decision on all roadway grade data to apply for all analyses prepared by or for the Department.

### **2.7.5 Sources for Roadway Grade Information**

Typically roadway grade information may be obtained from design plans once they have been developed for a project. Even when plans are available, the data may not meet the needs for the air quality analysis if the coverage does not include either the entire facility planned for emission and/or dispersion modeling or (typically) any affected facilities also selected for modeling such as nearby intersections. Reasonable approximations of roadway grade are needed for each of these situations. Sources of roadway grade data or elevation data from which reasonable approximations for roadway grade may be determined include but are not limited to:

- geographic information system (GIS) data, which may be based on various sources with differing resolution and accuracy,
- Google Earth and/or
- other government, research, and/or institutional data sites.

## **2.8 BACKGROUND CONCENTRATIONS**

Default background concentrations are provided in **Appendix H**. The following protocols apply for general and project-specific updates:

### **2.8.1 General Updates to Background Concentrations and/or Persistence Factors**

#### **2.8.1.1 Timing of Updates**

At its discretion, the Department may conduct updates periodically or as needed to the background concentrations and/or persistence factors that are provided as default values with this document.

#### **2.8.1.2 Methodology for General Updates**

Updates may be generated by applying the same technical procedures or methodology (based on applicable regulations and guidance) as applied for the previous or original tabulation to reflect more recent monitoring data. Refinements or changes to the methodology may also be applied as appropriate if the applicable regulatory requirements and/or guidance that are in effect at the time of the update have changed from the time that the previous tabulation was prepared.

### **2.8.1.3 Criteria for Additional Consultation for General Updates**

For areas subject to conformity requirements, additional inter-agency consultation for conformity purposes may be conducted for update(s) that differ substantively in methodology from that applied for the previous tabulation unless such differences are due to changes in the applicable regulations and/or guidance. Additional inter-agency consultation for conformity purposes may not be generally conducted otherwise.

### **2.8.1.4 Website Posting of General Updates**

General updates are posted to the Department website with the Resource Document.

## **2.8.2 Project Specific Updates to Background Concentrations and/or Persistence Factors**

### **2.8.2.1 Timing of Updates**

At its discretion, the Department may conduct project-specific updates or refinements to background concentrations and/or persistence factors, considering for example data availability and project location and context as appropriate.

### **2.8.2.2 Methodology for Project-Specific Updates**

Updates may be generated by applying the same technical procedures or methodology (based on applicable regulations and guidance) as applied for the previous or original tabulation to reflect more recent monitoring data and/or data more applicable for the specific project location. Refinements or changes to the methodology may also be applied as appropriate if the applicable regulatory requirements and/or guidance that are in effect at the time of the update have changed from the time that the previous tabulation was prepared.

### **2.8.2.3 Criteria for Additional Consultation for Project-Specific Updates**

Project-specific inter-agency consultation may be conducted for conformity purposes for projects for which update(s) are developed for which the methodology applied differs from that applied for this document and/or the results differ substantively from the values tabulated with this document for the project area. Such additional inter-agency consultation is generally not conducted otherwise.

### **2.8.2.4 Website Posting of Project-Specific Updates**

Project-specific updates are generally included in or with the documentation for the project-level air quality analysis that is made part of the NEPA documentation for the project, which typically is posted on its own Department webpage for major projects. Project-specific updates are generally not posted to the Department website with the Resource Document.

## **2.8.3 Ambient Air Quality Monitoring**

### **2.8.3.1 Updates to the Monitoring Network**

Following the addition, deletion or change in location of an air quality monitoring site, or change(s) at site(s) in pollutant(s) for which data are collected and/or data collection and analysis practices, the Department at its discretion may:

1. review and update the tabulation of background concentrations for the pollutant(s) affected as appropriate.

2. conduct inter-agency consultation for conformity purposes (if applicable) for the change(s), if the Department finds them to be substantive.

### **2.8.3.2 Near-Road Monitoring Sites**

Data from near-road monitoring sites are generally not considered appropriate for the determination of either background concentrations or persistence factors.

## **2.8.4 Exceptional and Exceptional-Type Events**

### **2.8.4.1 Consideration of Exceptional and Exceptional-Type Events in Determining Background Concentrations and/or Persistence Factors**

Adjustments to ambient air quality data for exceptional events may be made in updates to background concentrations and/or persistence factors provided the methodology is consistent with regulatory requirements and, as appropriate, guidance in effect at the time of the analysis.

This provision is extended to “exceptional-type” events if and when EPA extends the current Exceptional Events policy to cover situations in which background concentrations are influenced (increased) by an event but not to the extent that a violation of the NAAQS is observed. The general concept for such a policy was reviewed in detail in a recent National Cooperative Highway Research Program (NCHRP) study<sup>12</sup> in which EPA participated.

### **2.8.4.2 Documentation of Exceptional and Exceptional-Type Events**

Documentation of exceptional (or exceptional-type) analyses for this purpose may be conducted as an initiative of the Department and/or as part of joint initiatives that may involve multiple organizations, typically in coordination and consultation with VDEQ.

## **2.8.5 Future Background Concentrations**

### **2.8.5.1 Application of Regional Modeling Results**

Future background concentrations may be obtained or estimated from regional air quality modeling results provided the methodology is consistent with regulatory requirements and, as appropriate, guidance in effect at the time of the analysis (e.g., based on CTM modeling as currently specified by EPA)<sup>13</sup>.

### **2.8.5.2 Sources for Regional Modeling**

Regional modeling may be conducted by EPA, as part of regional initiatives that may involve multiple states and organizations (typically including EPA and VDEQ), and/or otherwise as an initiative of or supported by the Department.

<sup>12</sup> National Cooperative Highway Research Program (NCHRP) 25-25 Task 89, “*Establishing Representative Background Concentrations for Quantitative Hot-spot Analyses for Particulate Matter*”, prepared by Sonoma Technology, Inc. and The Louis Berger Group, Inc., October 2014. See: <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3514>

<sup>13</sup> Ibid. The NCHRP study identified three major steps for the application of CTM model data to calculate background PM concentrations for quantitative PM hot-spot analyses:

1. Identify representative PM monitoring site(s)
2. Assess the availability of suitable CTM model output and acquire the model data for the representative site(s) if the data exist
3. Determine PM background concentrations, following EPA requirements, for annual time periods.

### **2.8.5.3 Criteria for Additional Consultation for Updates based on Regional Modeling**

The development of CTM background concentrations according to the procedures noted above and the Department's review and acceptance would not require additional consultation beyond that conducted for this Resource Document.

### **2.8.5.4 Website Posting of Updates Based on Regional Modeling**

Since updates based on regional modeling may apply either generally or on a project-specific basis, website posting of updates to background concentrations and/or persistence factors will typically follow the protocols provided above respectively for updates of a general nature and updates that are project-specific.

## **2.9 NEARBY SOURCES**

Modeling of any nearby source(s) is conducted following applicable regulations and (as appropriate) guidance. In general, nearby sources need to be included in air quality modeling only when those sources would be affected by the project<sup>14</sup>, and the modeling may be generally limited as follows:

### **2.9.1 Limitations on Inventories and Forecasts for Nearby Stationary Sources**

The consideration of forecasts for emissions from nearby stationary sources is limited to readily available information including that provided by VDEQ working in consultation with other agencies or parties as appropriate. The Department will not develop or be responsible for developing operation, emission or dispersion modeling inventories or forecasts for nearby stationary sources, including current operations, changes in operations, expansions, opening of new facilities, effects of changes in technology, effects of changes in regulations and/or guidance affecting operations and/or technology, effects of market conditions on operational plans, etc.

### **2.9.2 Limitation to the Minimum Number of Model Runs**

Consistent with the protocol for limiting the number of modeling runs, the number of modeling runs for any analysis including nearby sources is generally kept to the minimum number of runs required by regulation and to maintain consistency as appropriate with guidance.

## **2.10 URBAN AND RURAL AREAS**

Designations of areas as either urban or rural for the purpose of dispersion modeling are made consistent with applicable regulations and as appropriate guidance. Consistent with guidance:

### **2.10.1 Projects in Rural Areas Not Expected to Become Urbanized**

Projects in isolated rural areas that are not expected to be urbanized in the timeframe of the forecasts (opening and design years as applicable) are generally treated as rural sources.

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<sup>14</sup> Section 8.2, *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM<sub>2.5</sub> and PM<sub>10</sub> Nonattainment and Maintenance Areas*, EPA-420-B-12-053, November 2013.

### ***2.10.2 Projects in Rural or Sub-Urban Areas That Are Expected to Become Urbanized***

Projects in rural areas, suburban areas, and any other areas that are expected to become urbanized by the modeling year(s) (project opening year and/or design year) are treated as urban sources for the respective modeling year.

## **2.11 INPUT DATA AND FILES**

### ***2.11.1 Updates to the Online Data Repository***

The data and files in the online data repository (which is addressed in a later section) may be updated periodically, following generally the methodology presented in this document and consistent with applicable regulations and as appropriate guidance at the time of the update. For example, whenever the MOVES input files applied in regional conformity analyses and/or the national emission inventory are updated (by VDEQ or the local metropolitan planning organization as appropriate), those updates may be taken as the basis for updates in whole or in part as appropriate to the input data and/or files presented in the appendix and posted on the VDOT website.

### ***2.11.2 Inter-Agency Consultation***

Inter-agency consultation for conformity purposes is typically not conducted for updates to the data and files posted in the online data repository if the updates simply reflect recent data or new assumptions, but follow procedures consistent with applicable regulations and guidance. Similarly, changes consistent with regional analyses including regional conformity analyses, and other regional analyses, such as may be conducted in support of revisions to the State Implementation Plan (SIP), which have already been subject to extensive consultation as part of the regional conformity process, are also not subject to additional inter-agency consultation for conformity purposes.

## **2.12 EMERGENCIES**

In emergencies (such as construction or reconstruction of a bridge or roadway on an emergency basis), air quality clearance processes may differ from those followed in non-emergency situations. In emergencies, clearances for air quality may be obtained after the fact consistent with applicable regulatory requirements. Projects may for example be exempted on the basis of safety from conformity (as applicable) and NEPA modeling and analysis requirements in such situations.

## 3. RESOURCES FOR CONFORMITY ANALYSES

This section and the associated appendices address the models, methods and assumptions specific for transportation conformity purposes (where applicable) for CO and PM<sub>2.5</sub>.

### 3.1 ONLINE DATA REPOSITORY

The Department has established an online data repository (DR) that contains a comprehensive set of modeling input data and files by county for currently applicable emission and dispersion models. The DR can be accessed through VDOT's Environmental webpage:

- <http://www.virginiadot.org/programs/pr-environmental.asp>

In general, where conformity applies for a specific pollutant, and in order to maintain consistency with regional emission analyses as required by the conformity regulation at 40 CFR 93.123(c)(3), input data for project-level modeling that are posted to the DR may be obtained to the extent reasonable and appropriate from regional conformity inputs prepared by the metropolitan planning organization (MPO). For emission modeling specifically, this typically includes data such as:

- Vehicle age distributions
- Fuel inputs
- I/M program parameters
- Meteorology
- Source type population (not used directly)

Where conformity does not apply for a specific pollutant, the above data are typically obtained from regional emission analyses prepared by VDEQ such as the modeling inputs for the national or Periodic Emission Inventory (PEI). This includes the traffic data generated by VDOT in support of the development of the PEI by VDEQ.

Similarly, for dispersion modeling, and although not required by the conformity regulation, general consistency in meteorological data with regional analyses may also be maintained as the data are typically obtained from VDEQ and, if not available from them, from EPA (or EPA models) as outlined below in the subsection on data for dispersion modeling.

Additionally, the DR includes sample input files for the emission and dispersion models. Copies (or excerpts of) sample model input files are presented in **Appendix J** of this document.

### 3.2 PROJECT ASSESSMENT

A project assessment is conducted to determine the appropriate level of analysis for a given project to meet all applicable regulatory requirements. In practice, assessments generally involve the identification of projects that qualify for certain exemptions provided in the federal conformity rule as well as any

available categorical finding (or programmatic agreement). Options currently available for assessing projects are reviewed in turn below, with corresponding data and information sources that may be applied in support of their application.

### 3.2.1 Exempt Status

Any and all exemptions provided in the federal transportation conformity rule and its future updates (and the corresponding state regulation and its future updates, if applicable) may be applied as appropriate for a project<sup>15</sup>.

**Appendix C** provides a list of the conformity exemption tables and associated source references. The federal transportation conformity rule at 40 CFR 93.126 provides a tabulation of project types that are exempt from the requirement to determine conformity, stating (in part) that: *“Notwithstanding the other requirements of this subpart, highway and transit projects of the types listed in table 2 of this section are exempt from the requirement to determine conformity. Such projects may proceed toward implementation even in the absence of a conforming transportation plan and TIP.”* The project types listed in Table 2 (entitled “Exempt Projects”) of 40 CFR 93.126 are generally grouped as safety, mass transit, air quality, and other projects.

Additional exemptions that apply only for regional analyses are provided in the federal conformity rule at 40 CFR 93.127. These additional exemptions apply for projects that would otherwise require a regional conformity analysis to amend the regional long range transportation plan and/or transportation improvement program, e.g., to add or delete the project or to modify its scope and/or schedule to the degree that would affect the modeling for the regional conformity analysis.

#### Data and Information Requirements:

Proposed projects are generally checked against the project types specified in 40 CFR 93.126 and 93.127 in order to determine the potential for exempt status in whole or in part. Other supporting data or information is generally not required for this purpose. If other supporting data or information are identified for a given project (such as supporting technical studies for safety projects, if not already specified in the project purpose and need statement), they typically are documented with the environmental clearance information prepared by or on behalf of the Department.

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<sup>15</sup> Projects listed as exempt for conformity purposes are typically also treated as exempt for purposes of NEPA.

### 3.2.2 Categorical Findings

The federal transportation conformity rule at 40 CFR 93.123(a)(3)<sup>16</sup> provides an option for the US DOT, in consultation with EPA, to make a categorical hot-spot finding for CO based on appropriate modeling. In February 2014, the US DOT, in consultation with EPA, implemented a new categorical finding for CO. **Appendix B1** provides the references to the latest categorical hotspot finding. This includes information on the application of the finding as part of a project-level conformity determination. The categorical finding for CO will be applied as appropriate for projects located in Virginia<sup>17</sup>.

Future updates to the federal categorical findings as well as any new federal categorical findings may also be applied in Virginia. Note a similar provision for a categorical finding for PM is specified in the rule at 40 CFR 93.123(b)(3)<sup>18</sup> although a finding for PM has not yet been developed. If and when a federal finding for PM is developed and implemented, it would also be applied as appropriate for projects located in Virginia.

#### Data and Information Requirements:

The data and forecasts needed to apply a categorical finding are generally a subset of the detailed information that would otherwise be needed to conduct project-specific modeling. The data needed for analyses are addressed in the resource document appendices and online data repository with the exception of the local project traffic data.

### 3.2.3 Application of Programmatic Agreements for Conformity Purposes

Programmatic agreements developed and implemented by the Department and the US DOT to streamline air quality analyses conducted for NEPA purposes are similar in design and documentation to categorical findings developed to meet conformity requirements. The US DOT consults with the US EPA in the development of categorical findings and may do the same for

- 
- <sup>16</sup> See <http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol20/xml/CR-2011-title40-vol20-sec93-123.xml>. Excerpt for CO (40 CFR 93.123(a)(3)): *DOT, in consultation with EPA, may also choose to make a categorical hot-spot finding that (93.116(a) is met without further hot-spot analysis for any project described in paragraphs (a)(1) and (a)(2) of this section based on appropriate modeling. DOT, in consultation with EPA, may also consider the current air quality circumstances of a given CO nonattainment or maintenance area in categorical hot-spot findings for applicable FHWA or FTA projects.*
- <sup>17</sup> FHWA has an update in preparation based on MOVES2014 for the original (2014) categorical finding, which was based on MOVES2010. Note, with the release of MOVES2014, EPA guidance indicates that the original 2014 categorical finding will be applicable only to the end of the MOVES2014 grace period ending 10/7/2016.
- <sup>18</sup> See: <http://www.gpo.gov/fdsys/pkg/CFR-2011-title40-vol20/xml/CFR-2011-title40-vol20-sec93-123.xml> . Excerpt for PM (40 CFR 93.123(b)(3)): *DOT, in consultation with EPA, may also choose to make a categorical hot-spot finding that § 93.116 is met without further hot-spot analysis for any project described in paragraph (b)(1) of this section based on appropriate modeling. DOT, in consultation with EPA, may also consider the current air quality circumstances of a given PM2.5 or PM10 nonattainment or maintenance area in categorical hot-spot findings for applicable FHWA or FTA projects.*

the agreements. Per the general protocols provided in **Section 2**, the application as appropriate of such programmatic agreements to projects located in areas subject to conformity is a reasonable and efficient means of ensuring consistency in assessing projects in all areas and streamlining the environmental clearance process. Therefore the following categories of programmatic agreements shall be considered applicable for both NEPA and conformity purposes for projects located in Virginia without requiring inter-agency consultation additional to that conducted on this Resource Document:

- Any national, state or regional programmatic agreement(s) designed and/or implemented by the US DOT in consultation with EPA for purposes of streamlining project-level air quality analyses conducted for NEPA purposes that would apply in Virginia<sup>19</sup>.
- Any programmatic agreement developed for Virginia and executed with the US DOT (including those based on a federal or national template) that is consistent with (or not substantively different from) the models, methods and assumptions identified in this Resource Document.

Links to the current national and VDOT programmatic agreements are provided in **Appendix B2** of the Resource Document.

#### Data and Information Requirements:

The data and forecasts needed to apply the programmatic agreement(s) are generally a subset of the detailed information that would otherwise be needed to conduct project-specific modeling. For application of the programmatic agreement(s) for projects located in Virginia, the data, forecasts and design information will typically be obtained or generated as referenced above for categorical findings.

#### **3.2.4 PM<sub>2.5</sub> Project Assessment Criteria**

VDOT has established assessment criteria to help identify non-exempt projects that clearly do not create new PM hot-spots or worsen existing air quality conditions. The criteria provided in **Appendix L** are based on federal regulations and guidance and the examples provided in the transportation conformity rule. For any project that meets the criteria and therefore would not be considered one of air quality concern for particulate matter, that determination and its basis will be documented in the air quality report for the project.

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<sup>19</sup> NCHRP 25-25 Task 78, “*Programmatic Agreements for Project-Level Air Quality Analyses Using MOVES, CAL3QHC/R and AERMOD*”, prepared by ICF International, Zamurs and Associates, LLC, and Volpe Transportation Systems Center, September 2015. (See: <http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3311>).

### Data and Information Requirements:

The data and forecasts needed for PM<sub>2.5</sub> project assessments are generally a subset of the detailed information that would otherwise be needed to conduct project-specific modeling. For assessment purposes, traffic volumes will typically represent daily conditions while level-of-service estimates and intermodal arrivals will represent the peak hour. If project traffic studies are not available at the time of assessment, other available data sources including information from regional or statewide modeling and/or traffic data from the Highway Performance Monitoring System (HPMS) may be used to determine local-specific criteria. The choice of alternative data sources for project assessment should be conducted in consultation with the Department. Typical project data needed for a level of analysis determination are presented in **Appendix D1**.

## 3.3 CO QUANTITATIVE HOT-SPOT ANALYSES

The following protocols and resources are typically used when conducting a CO project-level air quality analysis for transportation conformity purposes. Typically CO hot-spot analyses are conducted as screening level analyses with worst-case assumptions, which may include but not be limited to traffic and activity data forecasts, design features, emission model inputs, and dispersion model inputs that tend to generate high or worst-case results in terms of activity, emissions and concentrations.

### 3.3.1 Applicable Regulations, Guidance and Analysis Protocols

Links to currently applicable regulations and guidance are provided for reference purposes in **Appendix B1**. Note the general protocols provided in **Section 2** of this document apply for all modeling and analyses, including CO project-level air quality analyses.

### 3.3.2 Approved Models and Interfaces

Consistent with Department protocol, project-level air quality analyses are conducted with the latest official version of the emission and dispersion models following as appropriate any applicable grace period. Interface software may also be applied at the discretion of the Department and may include FHWA, EPA and/or vendor or third-party software. Resources for models are provided in **Appendix B3**.

Note, on July 14, 2015, EPA signed a proposal to revise the Guideline on Air Quality Models<sup>20</sup>. EPA is proposing to replace CALINE3 with AERMOD as the preferred model for determining near-field impacts for primary emissions from mobile sources, including PM<sub>2.5</sub>, PM<sub>10</sub>, and CO hot-spot analyses. Additionally, the proposal is supposed to enhance the formulation and application of the agency's AERMOD dispersion model, prescribe modeling techniques for secondarily formed fine particle and ozone pollution for single sources and makes various editorial improvements.

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<sup>20</sup> <http://www.epa.gov/ttn/scram/11thmodconf.htm>

### 3.3.3 Data Resources for Emission Modeling

A comprehensive set of modeling inputs for the region are provided in the online data repository, as noted in **Section 3.1**. These inputs may be used to support both screening and refined analyses, as separate “worst-case” inputs to EPA’s emission modeling software have not been defined. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local input files is also provided.

#### Available Resources

- **Appendix E1** lists typical sources for input data for emission modeling.
- **Appendix F** identifies current data available at the local level that can be used to support project-level analyses.
- **Appendix J1** provides examples of the file format(s) and content.

### 3.3.4 Data Resources for Dispersion Modeling

A comprehensive set of modeling inputs for the region are provided in the online data repository, as noted in **Section 3.1**. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local CAL3QHC input files is also provided.

#### Available Resources

- **Appendix G1-G2** lists data sources including typical and more conservative worst-case input data for dispersion modeling.
- **Appendix J2** provides sample CAL3QHC files as examples of the file format(s) and content.

### 3.3.5 Background Concentrations

Background concentrations for application in project-level air quality analyses are summarized in **Appendix H**. The estimates may be updated as needed on a project-specific basis; general updates may be limited to replacing the Background Concentration Memorandum in the appendix. Typical sources for the background concentrations include:

- Tabulations of recommended values provided by VDEQ, or
- Calculated values based on ambient air quality monitoring data provided by VDEQ and/or obtained from EPA for the most recent period for which appropriate data are available.

Adjustments to background concentrations may be made for exceptional (or exceptional-type) events consistent with EPA guidance (current and future updates as applicable), which may reference supporting research for details on methods and assumptions.

### 3.3.6 Construction Emissions

Construction activities have historically been considered temporary in nature and have not met the conformity criterion (five-years at one location) to be addressed in project-level air quality analyses. As a result, construction-related emissions are not typically addressed in project-level analyses. If and when the conformity criterion is met, construction-related emissions would be estimated following applicable regulatory requirements and as appropriate guidance.

### 3.3.7 Refined Modeling

Refined modeling is generally not needed for CO, as compliance with the applicable regulatory requirements typically is readily and cost-effectively demonstrated with screening approaches (worst-case analyses). The Department may nonetheless conduct refined modeling at its discretion. Refined modeling techniques would not typically rely upon worst-case assumptions but would include the use of local or project-specific data.

### 3.3.8 Mitigation

Mitigation measures may be applied consistent with regulatory requirements and, as appropriate, guidance (see **Appendix B1**). Mitigation measures may include but not be limited to those listed in **Appendix K1**.

## 3.4 PM<sub>2.5</sub> QUANTITATIVE HOT-SPOT ANALYSIS

The following protocols and resources should be used when conducting a PM<sub>2.5</sub> project-level air quality analysis for transportation conformity purposes.

### 3.4.1 Applicable Regulations, Guidance and Analysis Protocols

Links to currently applicable regulations and guidance are provided for reference purposes in **Appendix B1**. Note the general protocols provided in **Section 2** of this document apply for all modeling and analyses, including PM project-level air quality analyses.

In addition to the general protocols, the following protocol specific to PM analyses applies:

- The Department at its discretion may conduct a screening analysis for PM, consistent with regulatory requirements and as appropriate guidance and based on the latest official version of the screening model.

### 3.4.2 Approved Models and Interfaces

Consistent with Department protocol, project-level air quality analyses are conducted with the latest official version of the emission and dispersion models, following as appropriate any applicable grace period. Interface software may also be applied at the discretion of the Department and may include FHWA, EPA and/or vendor or third party utility software. Resources for models are provided in **Appendix B3**.

As referenced in **Section 3.3.2**, EPA has signed a proposal to revise the Guideline on Air Quality Models. EPA is proposing to replace CALINE3 with AERMOD as the preferred model for determining near-field impacts for primary emissions from mobile sources, including PM<sub>2.5</sub>, PM<sub>10</sub>, and CO hot-spot analyses.

### 3.4.3 Data Resources for Emission Modeling

A comprehensive set of modeling inputs are provided in the online data repository, as noted in **Section 3.1**. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local input files is also provided.

#### Available Resources

- **Appendix E2** lists typical sources for input data for emission modeling.
- **Appendix F** identifies current data available at the local level that can be used to support project-level analyses.
- **Appendix J1** provides examples of the file format(s) and content.

### 3.4.4 Data Resources for Dispersion Modeling

A comprehensive set of modeling inputs are provided in the online data repository, as noted in **Section 3.1**. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local input files is also provided.

Meteorological data are a key input for both the CAL3QHCR and AERMOD dispersion models, and the availability, age and quality of the data may impact the choice of dispersion model for an individual project-level analysis. Data may be obtained from the following sources:

- VDEQ, which currently prepares meteorological data files for the AERMOD dispersion model on a periodic basis. Copies of these files are available in the online data repository<sup>21</sup>.
- The most recent 5-year SCRAM surface and upper air meteorological data files provided on EPA's website<sup>22</sup>. A meteorological processor must be used to combine the SCRAM surface and upper air meteorological data into a single file for application with the CAL3QHCR model<sup>23</sup>.
- Online sources (typically for a fee). Data from commercial sources may be needed in cases in which data are not available or current.
- Project-specific meteorological data, which may be prepared following EPA's Guideline on Air Quality Models<sup>24</sup>.

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<sup>21</sup> VDEQ does not currently produce meteorological input files for the CAL3QHCR dispersion model.

<sup>22</sup> See: <http://www.epa.gov/ttn/scram/surfacemetdata.htm>

<sup>23</sup> PCRAMMET: [http://www.epa.gov/ttn/scram/metobsdata\\_procaccprogs.htm](http://www.epa.gov/ttn/scram/metobsdata_procaccprogs.htm)

<sup>24</sup> See: [http://www.epa.gov/scram001/guidance/guide/appw\\_99.pdf](http://www.epa.gov/scram001/guidance/guide/appw_99.pdf)

### Available Resources

- **Appendix G3** lists typical defaults for PM<sub>2.5</sub> dispersion modeling.
- **Appendices J3** and **J4** respectively provide samples of CAL3QHCR and AERMOD input files.
- **Appendix I** provides available meteorological data files and supporting documentation as downloaded from EPA's SCRAM website and files produced by DEQ for application with the CAL3QHCR and AERMOD models<sup>25</sup>.

### 3.4.5 Background Concentrations

Background concentrations for application in project-level air quality analyses are summarized in **Appendix H**. The estimates may be updated as needed on a project-specific basis. Typical sources for the background concentrations include:

- Tabulations of recommended values provided by VDEQ.
- Calculated values based on ambient air quality monitoring data provided by VDEQ and/or obtained from EPA for the most recent period for which appropriate data are available.
- Results from regional modeling conducted to meet applicable regulatory requirements and consistent as appropriate with guidance, for example forecast chemical transport modeling results (typically obtained from or in consultation with DEQ).

Adjustments to background concentrations may be made for exceptional (or exceptional-type) events consistent with EPA guidance (current and future updates as applicable), which may reference supporting research for details on methods and assumptions.

### 3.4.6 Construction Emissions

Construction historically has been temporary in nature and has not met the conformity criterion (greater than five-years at one location) to be addressed in project-level air quality analyses. As a result, construction-related emissions are not typically addressed in project-level analyses. If and when the conformity criterion is met, construction-related emissions would be estimated following applicable regulatory requirements and as appropriate guidance.

### 3.4.7 Mitigation

Mitigation measures may be applied consistent with regulatory requirements and, as appropriate, guidance (see **Appendix B1**). Mitigation measures may include but not be limited to those listed in **Appendix K2**.

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<sup>25</sup> FHWA does not at present have an approved methodology for converting AERMOD meteorological files to the formats needed by CAL3QHCR.

## 4. RESOURCES FOR PROJECT-LEVEL NEPA ANALYSES

### 4.1 ONLINE DATA REPOSITORY

The Department has established an online data repository (DR) that contains a comprehensive set of modeling input data and files by county for currently applicable emission and dispersion models. The DR can be accessed through VDOT's Environmental webpage:

- <http://www.virginiadot.org/programs/pr-environmental.asp>

In general, in order to maintain consistency to the extent reasonable and appropriate with regional emission analyses, input data (including those listed below) for project-level modeling that are posted to the DR may typically be obtained from national or PEI inputs prepared by VDEQ. For emission modeling specifically, this typically includes data such as:

- Vehicle age distributions
- Fuel inputs
- I/M program parameters
- Meteorology
- Source type population (not used directly)

This also includes the traffic data generated by VDOT in support of the development of the PEI by VDEQ.

For dispersion modeling, general consistency in meteorological data with regional analyses may also be maintained as the data are typically obtained from VDEQ or, if not available from them, from EPA (or EPA models) as outlined in the subsection below on data for dispersion modeling. Additionally, the DR includes sample input files for the emission and dispersion models. Copies (or excerpts of) sample model input files are presented in **Appendix J** of this document.

### 4.2 PROJECT ASSESSMENT

Project assessments are conducted to determine the appropriate level of analysis for a given project to meet all applicable regulatory requirements. In practice, assessments generally involve the identification of projects that qualify for certain exemptions provided in the federal conformity rule and/or would be covered by one or more programmatic agreement(s). Options currently available for assessing projects are reviewed in turn below, with corresponding data and information sources that may be applied in support of their application.

#### 4.2.1 Exempt Status

The exempt status of a project under the federal transportation conformity rule is a key consideration in determining the level of analysis expected for the NEPA study. **Section 3.2.1**

provides background information on the determination of exempt status for projects under the federal transportation conformity rule.

#### 4.2.2 CO Programmatic Agreements

The Department has executed a number of programmatic agreements with the US DOT, each of which may be updated periodically as applicable regulations, guidance and models are updated or revised. Additionally, new agreements are implemented as needed, including those falling in the general categories listed in **Section 3.2.3** (*Application of Programmatic Agreements for Conformity Purposes*). Therefore, at the discretion of the Department, any and all programmatic agreements in place at the time a project-level air quality analysis is initiated or updated, or implemented in the course of the analysis, may be applied for the analysis as long as the criteria for application as specified in the respective agreement(s) are met. **Appendix B2** provides links to current VDOT programmatic agreements that address or otherwise relate to the need to conduct air quality analyses.

#### 4.2.3 Application of Categorical Findings for Purposes of NEPA

**Section 3.2.2** addresses categorical findings that apply for purposes of conformity. The intent of this protocol is to effectively apply the technical criteria established in the federal categorical finding for purposes of NEPA as follows:

- Projects that meet the technical criteria specified in a categorical finding or findings may be cleared for purposes of NEPA for the pollutant(s) for which the criteria are met.
- The application of a federal categorical finding for conformity (or its technical criteria for purposes of NEPA, via this section) does not limit the application of a programmatic agreement for purposes of NEPA, if and where they may overlap. For example, if FHWA establishes a national programmatic agreement that establishes different criteria and covers different project types than the federal categorical finding, the intent would be to apply for purposes of NEPA either the programmatic agreement or the categorical finding (or in concept both) to clear the project, and not have the terms of one limit the application of the other.

This means that, in practice, if the technical criteria specified in the federal categorical finding for CO are met for a specific project, whether or not the project is located in an area subject to conformity, then project-specific modeling for CO would not be required for that project. Qualitative text documenting the clearance would still be needed for NEPA documentation purposes.

#### 4.2.4 MSATs Level of Analysis

Assessment for MSATs involves determining the level of analysis based on currently applicable FHWA guidance, which includes specific criteria for determining which projects are to be considered exempt from MSAT analysis requirements, which may require a qualitative analysis,

and which should undergo a quantitative assessment. **Appendix B1** identifies the currently applicable guidance for conducting MSATS analyses. Data and information needed for determining the level of analysis for MSATs are listed in **Appendix D3**.

#### 4.2.5 MSATs Programmatic Agreement (Future Option)

The Department may develop and implement with the US DOT a programmatic agreement for MSATs if and as appropriate, e.g. to update the thresholds specified in current guidance using local data (as presented or sourced in this document), to establish specific technical criteria for when a quantitative analysis is needed for build and no-build analyses, for combining the quantitative analysis for several concurrent projects in the same general area in one regional analysis for purposes of transparency and streamlining, etc. Such an agreement if implemented would be included in **Appendix B2** and posted on the VDOT website. It should be applied as appropriate for screening analyses for NEPA purposes.

### 4.3 NEPA-SPECIFIC PROTOCOLS

The general protocols provided in **Section 2** of this document apply as appropriate for all modeling and analyses, including NEPA project-level air quality analyses. In addition to the general protocols, the following protocol specific to NEPA analyses applies:

- Models and/or interface software that may be developed and implemented with the support of the US DOT and related research initiatives (including but not limited that undertaken by the Transportation Research Board, e.g., via the National Cooperative Highway Research Program or NCHRP) may, at the discretion of the Department, also be applied for NEPA analyses as appropriate. This may include interface and utility software provided in **Appendix B3**.
- Categorical findings that apply for conformity purposes will also apply for NEPA, as outlined in **Section 4.2.3**, Application of Categorical Findings for Purposes of NEPA.

### 4.4 CO PROJECT-LEVEL ANALYSES

A CO project-level analysis conducted for NEPA purposes should follow FHWA (not EPA) guidance and the general and NEPA-specific protocols established by the Department. For example, the process for selecting intersections for modeling differs in that EPA guidance specifies a detailed procedure whereas for NEPA the project sponsor may use judgment in selecting one or more (worst-case) intersections or project locations to model.

NEPA CO analyses are typically conducted based on combination of project-specific data (e.g. traffic volumes and speeds), default data specified in applicable guidance (e.g., meteorological inputs), and/or worst-case inputs (which may include traffic). Typical and more conservative worst-case input data for dispersion modeling are identified in the section for conformity, along with background concentrations.

A comprehensive set of modeling inputs for the region are provided in the online data repository, as noted in **Section 3.1**. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local input files is also provided.

### Available Resources

- See **Section 3.3.3 and 3.3.4**

## **4.5 MSATS PROJECT-LEVEL ANALYSES**

MSATs project-level analyses are conducted following FHWA guidance, the current version of which is listed in **Appendix B1**. In addition, copies of training materials provided by FHWA that provide detailed direction on the preparation of quantitative MSAT analyses are available from the Department Online Data Repository. The procedures used to conduct MSAT analyses prepared by or for the Department are expected to be consistent with those specified by FHWA in these training materials (including any future updates) as appropriate.

### **4.5.1 Determination of Affected Network**

Methods to identify the links to include in the affected network are provided in FHWA guidance and training materials referenced above. The methods include an assessment of project impacts on link-level traffic volume, travel time and intersection delay. All of the technical criteria (i.e., AADT, travel time and Level of Service) specified by FHWA for the determination of the affected environment (i.e., the affected links) are to be applied to the extent feasible (i.e., to the degree that the needed data/forecasts are available). The final set of affected links is then the combined set for all of the criteria.

Consistent with FHWA guidance, spurious changes that are not reasonably attributable to the proposed transportation improvements are to be eliminated from the final results for the MSAT analysis. Consistent with Protocol 2.6.3 specified in this Resource Document, any modifications to the results from the traffic analysis (including the proposed elimination of spurious links) must be done only by traffic staff with appropriate qualifications. Air quality staff that do not have appropriate training and experience in transportation modeling are not to modify the traffic data or forecasts for the project.

Ideally, GIS-based maps will be provided showing the affected links for each criterion alone and combined for all criteria, with changes that would result in increased emissions shown in red (e.g., volume increases) and changes that would result in decreasing emissions (e.g., volume reductions) shown in green. At a minimum, tables showing the calculations for the MSAT analysis (with increases and decreases in emissions color coded as above) should be included in the project file to be provided to VDOT.

### **4.5.2 Analysis Scenarios**

The Build/No-Build analysis is to be done for the affected network links only, not a subarea of the region that includes both the affected links and nearby links that do not meet the criteria for being considered to be affected.

Separate no-build networks should be identified for the project-opening and design years for each alternative. Streamlined approaches that deviate from this methodology must be approved by VDOT and/or FHWA in advance.

A comprehensive set of modeling inputs for the region are provided in the online data repository, as noted in **Section 4.1**. Updates to these data in whole or in part may be needed for application in any specific analysis. A sample set of local input files is also provided.

#### Available Resources

- **Appendix E3** lists typical sources for input data for emission modeling.
- **Appendix F** identifies current data available at the local level to support emission modeling.
- **Appendix J1** provides examples of the file format(s) and content.

## 4.6 INDIRECT EFFECTS AND CUMULATIVE IMPACTS ASSESSMENT

Indirect and cumulative effects for air quality are typically addressed in a qualitative manner. The Department template for project-level air quality analyses documentation provides an overview with examples<sup>26</sup>. More detailed analyses may be required for more complex projects and those for which an environmental impact statement is being prepared.

## 4.7 GREENHOUSE GASES

In the absence of applicable (final) federal guidance<sup>27</sup>, the Department policy is to provide qualitative greenhouse gas (GHG) analyses for projects involving an EIS. Quantitative analyses (i.e., modeling of GHG emissions) are not required. The Department template report (currently under development) for project-level air quality analyses will provide an example of a qualitative analysis for GHGs. If the project does not involve an EIS, then a GHG analysis (qualitative or quantitative) is not typically provided.

Once applicable (final) federal guidance is issued, it will be implemented as appropriate. Note FHWA is not expected to issue its guidance implementing the new CEQ guidance until the CEQ issues its final version.

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<sup>26</sup> *To be made available on the Department website.*

<sup>27</sup> On December 24, 2014, the Council of Environmental Quality (CEQ) issued "Revised Draft Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA Reviews". It provides direction to Federal agencies on when and how to consider the effects of GHG emissions and climate change in the evaluation of proposed Federal actions in accordance with NEPA. As of the date of preparation of this document, CEQ has not yet finalized its Revised Draft Guidance nor has FHWA issued corresponding guidance.

## APPENDIX A: INTERAGENCY CONSULTATION

A1: IACC Meeting Minutes (including email transmittals)

A2: IACC Meeting Presentation

A3: December 2015 Draft Resource Document (sections relating to conformity that were subjected to consultation)

(Not included here due to length, but is available at: <http://outsidevdot.cov.virginia.gov>)

**Final Meeting Minutes****Inter-Agency Consultation for Conformity (IACC)**  
*VDOT Project-Level Air Quality Resource Document****Date/Time:***

12/14/15 - 10:00-12:00pm

***Location (also by webinar):***

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS  
 DEP Conference Room (3rd Floor)  
 777 North Capitol Street, NE • Suite 300 •  
 Washington, DC 20002

**Attendees:*****In-Person at MWCOG:***

<b>Name</b>	<b>Agency</b>
James Ponticello	VDOT
Daniel Grinnell	VDOT
Eulalie Gower-Lucas	MWCOG
Ronald Milone	MWCOG
Dusan Vuksan	MWCOG
Jane Posey	MWCOG
Tim Roseboom	DRPT
Daniel Szekeres	Michael Baker International
Robert d'Abadie	Michael Baker International

***On Webinar:***

<b>Name</b>	<b>Agency</b>
Christopher Voigt	VDOT
Andrew Beacher	VDOT
Sonya Lewis-Cheatham	DEQ
Ed Sundra	FHWA
Paul Heishman	FHWA – Resource Center
Asrah Khadr	EPA Region III

**Meeting Minutes:**

- Jim Ponticello opened the meeting by providing a brief overview of VDOT's efforts in developing a resource document. The VDOT Project-Level Air Quality Resource Document was developed as a key resource to support future project-level conformity analyses. To satisfy transportation conformity consultation requirements, this meeting is being held to review the models, methods, and assumptions included in the document.
- All attendees (both for those in-person and on the webinar) provided an introduction.

- Dan Szekeres of Michael Baker International conducted a presentation (**attached with meeting minutes**) on the VDOT Project-Level Air Quality Resource Document. The presentation was divided into two sections: (1) overview of the Resource Document and (2) review of PM<sub>2.5</sub> project assessment criteria. The presentation followed the outline of the Resource Document to facilitate the review by the consultation partners, who could refer to the main document for additional detail as they followed the presentation.
- Upon completion of the first part of the presentation (overview of Resource Document), Dan Szekeres asked if there were any questions or comments on the document contents.
  - Tim Roseboom (DRPT) recommended that Section 2.6 (Traffic) be revised to include references to existing and forecast transit ridership data that may be used during a project-level analysis. VDOT agreed to make this change to the Resource Document.
  - Eulalie Lucas (MWCOCG) recommended that Appendix F and other sections, as appropriate, be updated to reflect the optional use of EPA's vehicle age projection tool. MWCOCG does not currently use this tool. VDOT agreed to make this change to the Resource Document.
  - Eulalie Lucas (MWCOCG) asked if there were any consistency issues in using different meteorological data sources for MOVES emission modeling as compared to dispersion modeling. Dan Szekeres (Michael Baker Intl.) indicated that meteorological input detail is different between MOVES and dispersion models (AERMOD, CAL3QHCR). Dispersion models require much more detailed information than EPA's MOVES model. For AERMOD, DEQ prepares meteorological inputs based on processing of hourly surface data from local airports in the region. DEQ does not prepare information for the CAL3QHCR model. As a result, available information from EPA's SCRAM website is one key source of information (as noted in Resource Document), however, that data may be much older and may not be consistent with recent meteorological conditions including those input to the MOVES emission model for regional conformity.
- Upon completion of the second part of the presentation (review of PM<sub>2.5</sub> project assessment criteria), Dan Szekeres asked if there were any questions or comments on the document contents.
  - Dusan Vuksan (MWCOCG) asked about the general validity of some truck forecasts conducted for a project-level analysis, as trucks are key criteria for evaluating whether a formal hot-spot analysis is required. Robert d'Abadie (Michael Baker Intl.) indicated that this is an important issue and why the VDOT Resource Document requires experienced traffic engineers to provide such data for air quality analyses. Rob indicated that travel model results should be reviewed and, if necessary, adjusted (via post processing) before use in evaluating whether a project may be of "air quality concern". Dusan agreed that post processing is an important issue and noted that emphasis on this point may be recommended for the Resource Document.
- No other comments were received on the Resource Document and PM<sub>2.5</sub> project assessment criteria.
- Jim Ponticello indicated that VDOT is open to the potential use of the Resource Document as a template for other agencies including DDOT or MDOT.
- The meeting was adjourned at 11:50am

**Attachment:**

**Email Notices for IACC Meeting**

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From: Szekeres, Dan

Sent: Tuesday, November 24, 2015 7:41 AM

To: paul.heishman@dot.gov; 'Ed Sundra@fhwa dot gov' (Ed Sundra@fhwa dot gov); Michael.Claggett@dot.gov; jeff.houk@dot.gov; Cecilia.Ho@dot.gov; khadr.asrah@epa.gov; Lewis-Cheatham, Sonya (DEQ) (Sonya.Lewis-Cheatham@deq.virginia.gov); Kiss, Michael (DEQ) (Michael.Kiss@deq.virginia.gov); Charles.turner@deq.virginia.gov; 'Thomas.Ballou@deq.virginia.gov'; 'ksrikanth@mwco.org'; elucas@mwco.org; 'melissa.barlow@dot.gov'; 'Norman.Whitaker@vdot.virginia.gov'; 'John.Muse@VDOT.Virginia.gov'; 'Tim.Roseboom@drpt.virginia.gov'; 'Wendy.Sanford@fairfaxva.gov'; 'rcanizales@pwcgov.org'; 'Smitha.Chellappa@fairfaxcounty.gov'; 'Lisa.Jaatinen@alexandriava.gov'; 'k.alexander@manassasparkva.gov'; 'BGoudarzi@ci.manassas.va.us'; 'Joe.kroboth@loudoun.gov'; 'marcus@arlingtonva.us'; 'mcollins@fallschurchva.gov'; 'djohnson@viennava.gov'; 'Dana.singer@herndon-va.gov'

Cc: Ponticello, James (Jim.Ponticello@VDOT.Virginia.gov); Voigt, Christopher G. (VDOT) (Christopher.Voigt@VDOT.Virginia.gov); Dabadie, Robert, Chung, Ying-Tzu, Grinnell, Daniel T. (VDOT) (Daniel.Grinnell@VDOT.Virginia.gov)

Subject: Notice for 12-14-15 Consultation Meeting/Webinar on VDOT's Air Quality Resource Document

All,

VDOT has developed a draft Resource Document to facilitate and streamline the preparation of project-level air quality analyses. It is intended as a resource for modelers to help ensure that regulatory requirements and guidance are met in all analyses. It addresses the models, methods and assumptions (including data and data sources) needed for the preparation of air quality analyses for transportation projects by or on behalf of the Department and will be complemented by an online data repository. It is intended that the transportation conformity portions of the document and associated files will undergo interagency consultation.

A consultation meeting has been setup for December 14th from 10-12pm. A webinar option will be available to those who can't attend in person. The meeting will include an overview of the Resource Document and files. The meeting will take place at:

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS  
777 North Capitol Street, NE • Suite 300 • Washington, DC 20002  
Phone: 202.962.3200

If you are available, please reserve this time on your calendar. Additional materials (including agenda, presentation, and Resource Document links) will be forthcoming.

Thanks for your support.

Dan

Dan Szekeres | Technical Manager | Michael Baker International  
4431 N. Front Street, 2nd Floor | Harrisburg, PA 17110 | [O] 717-221-2019 | [M] 717-579-2501

dszekeres@mbakerintl.com | www.mbakerintl.com

From: Szekeeres, Dan

**Sent: Friday, December 04, 2015 3:57 PM**

To: paul.heishman@dot.gov; 'Ed.Sundra@fhwa.dot.gov'  
(Ed.Sundra@fhwa.dot.gov); Michael.Claggett@dot.gov; jeff.houk@dot.gov;  
Cecilia.Ho@dot.gov; khadr.asrah@epa.gov; Lewis-Cheatham, Sonya (DEQ)  
(Sonya.Lewis-Cheatham@deq.virginia.gov); Kiss, Michael (DEQ)  
(Michael.Kiss@deq.virginia.gov); Charles.turner@deq.virginia.gov;  
'Thomas.Ballou@deq.virginia.gov'; 'ksrikanth@mwccog.org';  
elucas@mwccog.org; 'melissa.barlow@dot.gov';  
'Norman.Whitaker@vdot.virginia.gov'; 'John.Muse@VDOT.Virginia.gov';  
'Tim.Roseboom@drpt.virginia.gov'; 'Wendy.Sanford@fairfaxva.gov';  
'reanizales@pwcgov.org'; 'Smitha.Chellappa@fairfaxcounty.gov';  
'Lisa.Jaatinen@alexandriava.gov'; 'k.alexander@manassasparkva.gov';  
'BGoudarzi@ci.manassas.va.us'; 'Joe.kroboth@loudoun.gov';  
'marcus@arlingtonva.us'; 'mcollins@fallschurchva.gov';  
'johnson@viennava.gov'; 'Dana.singer@herndon-va.gov'

Cc: Ponticello, James (Jim.Ponticello@VDOT.Virginia.gov); Voigt, Christopher G.  
(VDOT) (Christopher.Voigt@VDOT.Virginia.gov); Dabadie, Robert; Chung,  
Ying-Tzu; Grinnell, Daniel T. (VDOT) (Daniel.Grinnell@VDOT.Virginia.gov)

Subject: Webinar Access & Materials for 12-14-15 Consultation Meeting on VDOT's Air Quality Resource Document

Attachments: Presentation (ver 12-03-15) VDOT Resource Document Consultation Meeting.pdf; Draft (ver 12-03-15) VDOT Project-Level Air Quality Resource Document for Consultation (No NEPA Section).pdf; Draft (ver 11-25-15) VDOT Background Concentration Memo (CONFORMITY).pdf; Draft (ver 11-24-15) VDOT Supporting Files Summary.pdf

All,

Reminder:

Virginia Interagency Consultation Group - Review of VDOT Project-Level Air Quality Resource Document

\* Date/Time:

December 14th from 10-12pm (Please arrive 15min early to get through security sign-in)

\*Location:

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS  
DEP Conference Room (3rd Floor)  
777 North Capitol Street, NE • Suite 300 • Washington, DC 20002  
Phone: 202.962.3200

Webinar Access Information:

<To be provided before meeting>

Meeting Materials:

We are providing meeting reference materials that include:

\* Meeting presentation (attached PDF)

\* Draft AQ Resource Document with pertinent sections for consultation review (attached PDF - Note Chapter 4 NEPA materials removed)

\* Draft Background concentrations memo (attached PDF)

\* Summary of supporting modeling files to be provided in the online data repository (attached PDF)

In addition (if interested), we are also providing access to the actual online data repository files (SupportingFiles.zip) which can be accessed via the FTP link below:

\* <https://eFTP.mbakerintl.com/message/z0ZOEQxcMmK9AVrQpiHqkx>

The consultation meeting presentation will focus on conducting a thorough review of the Resource Document and Data Repository contents and key consultation items.

If you have any problems accessing these files or additional comments before the meeting, please let us know. Thanks for your assistance in meeting our consultation requirements for this effort.

Dan

Dan Szekeres | Technical Manager | Michael Baker International  
4431 N. Front Street, 2nd Floor | Harrisburg, PA 17110 | [O] 717-221-2019 | [M] 717-579-2501  
[dszekeres@mbakerintl.com](mailto:dszekeres@mbakerintl.com) | [www.mbakerintl.com](http://www.mbakerintl.com)

From: Szekeres, Dan

**Sent: Thursday, December 10, 2015 2:54 PM**

To: paul.heishman@dot.gov; 'Ed.Sundra@fhwa.dot.gov'  
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Cc: Ponticello, James (Jim.Ponticello@VDOT.Virginia.gov); Voigt, Christopher G.  
(VDOT) (Christopher.Voigt@VDOT.Virginia.gov); Dabadie, Robert; Chung,  
Ying-Tzu; Grinnell, Daniel T. (VDOT) (Daniel.Grinnell@VDOT.Virginia.gov)

Subject: RE: Webinar Access & Materials for 12-14-15 Consultation Meeting on VDOT's Air Quality Resource Document

Attachments: Presentation (ver 12-10-15) VDOT Resource Document Consultation Meeting.pdf

All,

As a follow-up to the December 4th reminder email, Webinar Access Information is being provided below for the December 14th consultation meeting on the VDOT Project-Level Air Quality Resource Document. In addition, several minor modifications have been made to the presentation (attached).

Reminder:

Virginia Interagency Consultation Group - Review of VDOT Project-Level Air Quality Resource Document

\* Date/Time: December 14th from 10-12pm (Please arrive 15min early to get through security sign-in)

\* Location:

METROPOLITAN WASHINGTON COUNCIL OF GOVERNMENTS  
DEP Conference Room (3rd Floor)  
777 North Capitol Street, NE • Suite 300 •  
Washington, DC 20002 • Phone: 202.962.3200

Webinar Access Information:

Join WebEx meeting  
Meeting number: 641 881 658  
Meeting password: VDOT\_AQC

Join by phone  
1-855-244-8681 Call-in toll-free number (US/Canada)  
1-650-479-3207 Call-in toll number (US/Canada)  
Access code: 641 881 658  
Global call-in numbers | Toll-free calling restrictions

Can't join the meeting? Contact support  
Let us know if you have any problems or questions.

Thanks,

Dan

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**VDOT's Project-Level Air Quality Resource Document and Online Data Repository**  
*(Transportation Conformity Portion)*

Interagency Consultation Meeting  
December 14, 2015

VDOT

**1**

**Resource Document Background**

VDOT

**Meeting Agenda**

- 1. Resource Document**
  - Background
  - Document Contents
  - Appendices
  - Discussion
- 2. PM<sub>2.5</sub> Project Assessment Criteria**
  - Overview of Criteria
  - Discussion

VDOT

**Resource Document Analysis Objectives**

- To streamline and otherwise facilitate project-level air quality analyses prepared by and/or on behalf of VDOT
- Resource for modelers to ensure regulatory requirements are consistently achieved
- Online data repository to support modeling

**Focus of Resource Document**

Project-Level Air Quality Modeling

Relevant Pollutants: CO, PM<sub>2.5</sub>

VDOT

**Federal Regulations** (project-level conformity)

- Conformity Rule - 40 CFR 93.105 (c)(1)(i)**
  - Interagency consultation procedures shall include a process involving the MPO, State and local transportation agencies, EPA and DOT for:
 

*"Evaluating and choosing a model (or models) and associated methods and assumptions to be used in hot-spot analyses and regional emissions analyses"*

**VDOT** 7

**Resource Document Consultation Objectives**

- Meet EPA Transportation Conformity requirement
  - **Focus on models, methods, and assumptions**
  - NEPA analyses are not subject to the conformity rule, so related sections of the Resource Document (e.g., Chapter 4) are not included in IACC
- Agreeing on **PM<sub>2.5</sub> project assessment criteria** that limit consultation to those projects that may be of air quality concern

**VDOT** 5

**Regional Regulations** (project-level conformity)

- Virginia Administrative Code**
  - Consistent with Federal Conformity Rule
  - Consultation: MPOs, LPOs, DEQ, VDOT, VDRPT, EPA, FHWA, and FTA
- TPB Consultation Procedures**
  - Consistent with Conformity Rule

*"Should such project level analysis be required, it will be the responsibility of the appropriate state and/or local air agency in each jurisdiction to notify implementing agencies and other project sponsors of such analytical and subsequent procedural/consultation requirements"*

**VDOT** 8

**Federal Regulations** (project-level conformity)

- Conformity Rule - 40 CFR 93.123**
  - Requirements and procedures for determining localized CO, PM<sub>2.5</sub> and PM<sub>10</sub> concentrations (hot-spot analysis)
  - Categorical hot-spot finding (currently only for CO)

(40 CFR 93.123(c))

*"Hot-spot analysis assumptions must be consistent with those in the regional emissions analysis for those inputs which are required for both analyses"*

**VDOT** 9

### Project-Level Conformity Guidance

#### EPA and FHWA Guidance for Quantitative PM Hot-spot Analyses

- Latest version released in November 2015
- Methods and procedures using MOVES2014
- Additional guidance on consultation requirements

#### EPA Guidance for Using MOVES2014 in Project-Level CO Analyses

- Latest version released in March 2015
- Methods and procedures using MOVES2014



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### Project-Level Conformity Guidance on Consultation Efforts

**Per PM Hot-Spot Guidance (Section 2.3):**

- "... the general requirement for interagency consultation can be satisfied **without consulting separately on each and every specific decision that arises.**"
- "... agencies have **discretion as to how they consult** on hot-spot analyses."
- "... agencies involved in the consultation process could **develop procedures that will apply for any PM hot-spot analysis** and agree that any departures from procedures would be discussed by involved agencies."



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### Project-Level Conformity Northern Virginia

#### 1997 Annual PM<sub>2.5</sub>

- Northern Virginia (NOVA)
- EPA has proposed to revoke standard as part of draft implementation plan for 2012 NAAQS

#### Carbon Monoxide (CO)

- Alexandria and Arlington County
- Maintenance status expires 3/22/2016



Alexandria County\*  
Arlington County  
Fairfax County  
Loudoun County  
Prince William County  
Stafford County  
City of Alexandria\*  
City of Fairfax  
City of Falls Church  
City of Herndon  
City of Reston  
Park



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### Resource Document Document Contents



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### Definition of Substantive Change

- One that would reasonably be expected to affect the modeling results and/or analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared.
- For analyses involving project-specific dispersion modeling for any pollutant(s) for conformity purposes, this includes whether the project would pass the applicable conformity test(s).

**VDOT** 15

### Summary of Resource Document (RD) Contents

- Section 1.2.3.1.3 Standard Text for Project-Level Documentation
- Section 2.1.2.3.2 General Analysis Protocols
- Section 3.1 Online Data Repository
- Section 3.2 Project Assessment Methods and Criteria
- Section 3.3 CO Hot-Spot Analysis Resources
- Section 3.4 PM<sub>2.5</sub> Hot-Spot Analysis Resources
- Appendix A1 Resource Appendices

**VDOT** 13

### General Protocols

#### Latest Regulations and Guidance

- Analyses conducted to meet all applicable regulatory requirements and guidance at time analysis initiated
- Process for responding to deficiencies identified in models, regulations, or guidance

#### Initiating a Project-Level Analysis

- For project sponsors, VDOT should be consulted early in process for any departures from the RD methods & data
- For determining whether project initiated within a grace period (e.g., for a model update), identify and document analysis start date which should be earliest of date (1) task was assigned, (2) traffic or design info requested, (3) project info gathering initiated, (4) modeling initiated, or (5) other.

**VDOT** 16

### Standard Text for Project-Level Documentation

- "inter-agency consultation ... was conducted on the models, methods and assumptions specified in the Department Resource Document for Project-Level Air Quality Analyses which were applied in this analysis either directly or without substantive change."
- Text provided to reference additional consultation that may be conducted if:
  - Procedures different than the RD
  - Complex projects and/or ones of greater interest to the public and other stakeholders

**VDOT** 14

### General Protocols (continued)

**Updates to Project-Level Analyses**

Section 2.3

- If the overall NEPA document is being re-evaluated or supplemented for air quality reasons
- If VDOT concludes changes in models, methods and/or assumptions from original analysis are substantive
- Consultation conducted only for changes that are substantively different from both original analysis and RD

**Process Improvement**

Section 2.4

- VDOT may implement improved processes and/or procedures
- Includes best practices as well as applied research
- Consultation limited to changes identified as substantive

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### General Protocols (continued)

**Streamlining (to extent feasible)**

Section 2.5

- Analyses in excess of regulatory requirements are not conducted except at discretion of VDOT (projects, Pollutants, Project Area, Allocation facilities)
- Modeling Tests and Number of Runs, Screening and Worst-Case Analyses, Interface & Utility Software

**Traffic**

Section 2.6

- Prepared or specified by appropriate traffic engineering and transportation planning staff. *Exception:* Assembling readily-available data, e.g., VDOT TMS/HPMS & PEI data.
- Lowest cost / simplest options typically selected, i.e., avg speeds (not drive schedules or op-mode). Micro-simulation not typically applied

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### General Protocols (continued)

**Roadway Grade**

Section 2.7

- Threshold magnitude for modeling changes is between 2 and 5% depending on truck percentage
- Grades < threshold: Model Flat or at average grade
- Grades > threshold: Average grade for each segment

• Refined analyses may use more detailed road grade data

• Grade data sources may include readily available information (e.g. GIS, Google Earth, other data sites)

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### General Protocols (continued)

**Background Concentrations**

Section 2.8

- Defaults provided in Appendix (using VDEQ data)
- General vs project-specific updates, & Network Monitoring Updates
- Exceptional & E-type events – EPA Guidance (2016)
- Future background concentrations may be obtained from regional air quality modeling results if methodology consistent with regulatory requirements and guidance

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### General Protocols (continued)

**Nearby Sources**

- Include in air quality modeling only when those sources would be affected by the project
- Emission forecasts from nearby stationary sources is limited to readily available information including that provided by VDEQ working in consultation with other agencies
- Limitation on number of modeling runs

**Urban and Rural Areas**

- Projects in rural, suburban, or other areas that are expected to become urbanized by modeling years are treated as urban sources (consistent with EPA guidance)

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### General Protocols (continued)

**Input Data and Files**

- Online data repository may be updated periodically, following generally the methodology in RD
- Typically consultation not conducted for updates if consistent with regulations and guidance and apply recent data / new assumptions

**Emergencies**

- In emergencies (such as construction or reconstruction of a bridge or roadway on an emergency basis), air quality clearance processes may differ from those followed in non-emergency situations
- May be after the fact, or exempted on basis of safety

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### Resources for Conformity Analyses

Consultation Focus on Conformity

Online Data Repository (DR)	Project Assessment Methods and Criteria
CO Hot-Spot Analysis Resources	PM <sub>2.5</sub> Hot-Spot Analysis Resources

If the CALINE models replaced by the VDOT will transition to the models specified by EPA (AERMOD) following federal requirements and guidance. Additional IACC would not be needed for the RD unless there are departures from those requirements and guidance.

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### Online Data Repository

**VDOT Environmental Website:**  
<http://www.virginia.gov/programs/air-environmental.asp>  
<http://outair.vdot.com/virginia.gov>  
*Registration Required*

- Houses data needed to support emissions and dispersion modeling
  - MOVES / CAL3QHC / CAL3QHCR / AERMOD
- Data sources include:
  - MWCOG for conformity files (consistency with regional analyses)
  - DEQ for SIP and NEI files
- Final selection or specification of data for project level analyses rests with VDOT (General Protocol, Chapter 2)

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### Existing Programmatic Agreements (PAs)

- Project-Level Carbon Monoxide Air Quality Studies Agreement (2009)
- No-Build Analysis Agreement for Air and Noise Studies (2009)
- Procedure for Updating Air Studies When New Planning Assumptions Become Available (2004)
- Project-Level Carbon Monoxide Air Quality Studies Agreement (Pending), based on NCHRP 25-25 Task 78 (2015) template

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### Protocol for Updates to Online Data Repository

- ☐ To be updated periodically following the methodology presented in RD and to ensure consistency with regional emission analyses where required for conformity
- ☐ Inter-agency consultation for conformity purposes is typically **not** conducted for updates to the data and files posted in the online data repository if the updates simply reflect recent data or new assumptions, but follow procedures consistent with applicable regulations and guidance.

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### Application of PAs for Conformity Purposes

- Any national, state or regional programmatic agreement(s) designed and/or implemented by the US DOT in consultation with EPA for purposes of streamlining project-level air quality analyses conducted for NEPA purposes that would apply in Virginia.
- Any programmatic agreement developed for Virginia and executed with the US DOT (including those based on a federal or national template) that is consistent with (or not substantively different from) the models, methods and assumptions identified in this Resource Document.

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### How Addressed in Resource Document



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### CO Hot-Spot Analysis Resources

**Appendices provided for:**

- Reference Information
- Data Resources for Modeling
- Background Concentrations
- Mitigation Measures

Regulations, Guidelines, Analysis Methods

Approved models and software

↓

What case inputs for dispersion modeling

- Construction emissions**
  - Estimated following regulatory requirements and guidance if criterion met (five years or less of construction at an individual site – 40 CFR 93.123(c)(3))
- Refined modeling is generally not needed for CO**
  - Typically demonstrated with screening approaches (worst case analyses)

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## Resource Document Document Appendices

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### PM<sub>2.5</sub> Hot-Spot Analysis Resources

- Appendices provided for:**
  - Reference Information
  - Data Resources for Modeling
  - Background Concentrations
  - Construction Emissions
  - Mitigation Measures
- Choice of Dispersion Models (CAL3QHCR / AERMOD)**
  - Meteorological data may impact choice of model
  - Key sources: VDEC, EPA SCRAM, other online sources, project specific data prepared using EPA's *Guideline on Air Quality Models*
- VDOT at its discretion may conduct a screening analysis, consistent with requirements & guidance**

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### Summary of Resource Document Appendices

A	Interagency Consultation	B	References and Resources	C	Conformity Exemption Tables	D	Traffic Data Needs for Assessments and Analyses
E	Input Data Sources for MOVES Modeling	F	Local MOVES Model Data	G	Default Dispersion Model Parameters	H	Default Background Concentrations
I	Default Meteorological Data	J	Sample Model Input Files	K	Example Mitigation Measures	L	Project Assessment Methods and Criteria

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### Default Background Concentrations

- Currently based on 2011-2013 monitor data
  - CO – 2<sup>nd</sup> maximum concentration for most recent two year period
  - PM<sub>2.5</sub> – 3 year average of annual concentrations

Region	2012-2013 Background Concentration (ppm)
Reston	1.0
McLean/Center and Herndon, VA	1.4

Region	Background Concentration (µg/m <sup>3</sup> )
Arlington County & Alexandria City	9.4
Reston/Leesville/VA	8.8

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### CO Monitor Trends for NOVA

National Ambient Air Quality Standard (NAAQS)

Primary Standard for CO

- 8-hour average not to exceed 9 ppm (15 mg/m<sup>3</sup>) over three years per year.
- 1-hour average not to exceed 35 ppm (60 mg/m<sup>3</sup>) more than once per year.

Virginia Ambient Air Monitoring 2014 Data Report

Department of Environmental Quality

Arlington

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### Default Meteorological Data for PM<sub>2.5</sub> Analyses (Appendix I)

- AERMOD**
  - Provided by DEQ
  - Process for developing data files provided in Appendix I3
  - Contains the most recent 5 years AERMET meteorological data for the DCA (Ronald Reagan) and IAD (Dulles) airports
  - Included in DR (AERMOD.ZIP)
- CAL3QHCR**
  - Not available from DEQ
  - Assembled EPA SCRAM (most recent 5 years) surface and upper air data for the DCA (Ronald Reagan) and IAD (Dulles) airports
  - Included in DR (CAL3QHCR.ZIP)
  - Requires pre-processing through PCRAMMET software

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### PM<sub>2.5</sub> Monitor Trends for NOVA

Table 2a: PM<sub>2.5</sub> Design Values for Virginia Monitors

Site ID	Region	Year	City	2011-2013 Three Year Average (µg/m <sup>3</sup> )	Annual
01010023	Reston	2011	Arlington	9.4	9.4
01010024	Reston	2012	Arlington	9.4	9.4
01010025	Reston	2013	Arlington	9.4	9.4

Arlington

2011-2013 PM<sub>2.5</sub> Monitor Data

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**Resource Document  
Discussion**

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**Sample Project Level Input Files  
(Appendix J)**

- Sample dispersion model input files provided as resource for project-level analyses
- Included in DR
  - CAL3QHCR.ZIP (Sample inputs with worst-case defaults)
  - CAL3QHCR.ZIP (Sample inputs and run outputs)
  - AERMOD.ZIP (Sample inputs and run outputs)

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**2 PM<sub>2.5</sub> Project Assessment Criteria  
Overview of Criteria**

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**Mitigation Measures  
(Appendix K)**

- Mitigation measures applied consistent with regulatory requirements and, as appropriate, guidance
- Mitigation measures may include but not be limited to those listed in Resource Document
  - FHWA / EPA Hot-spot Guidance

**APPENDIX K: AIR QUALITY MITIGATION MEASURES**  
Revised to 12/2018/10/2019

**FOR THE USE OF THE AIR QUALITY MITIGATION MEASURES TO BE USED BY THE DESIGNER AND THE CONTRACTOR TO DEVELOP THE AIR QUALITY MITIGATION MEASURES FOR THE PROJECT. THE MITIGATION MEASURES SHOULD BE DEVELOPED IN CONFORMANCE WITH THE FOLLOWING GUIDANCE:**

1. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
2. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
3. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
4. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
5. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
6. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
7. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
8. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
9. The mitigation measures should be developed in accordance with the guidance provided in this appendix.
10. The mitigation measures should be developed in accordance with the guidance provided in this appendix.

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### PM<sub>2.5</sub> Assessment Criteria

Assessment Level	Who Makes Decision?
<b>LEVEL 1</b> Is the project exempt?	VDOT
<b>LEVEL 2</b> Is the project clearly NOT of AQ concern?	VDOT (Using ICG-Reviewed Resource Documents)
<b>LEVEL 3</b> For projects that cannot be excluded in Level 1 or 2, is the project of AQ concern?	VDOT (Project-Specific Consultation)

↓  
Determination if Project is of "Air Quality Concern"


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### Key Considerations for Determining Projects of "Air Quality Concern"

- Applicable CAA Regulations and Guidance**
  - CAA Citations
  - Transportation Conformity Regulations
  - EPA Guidance Examples
- Traffic**
  - Diesel Truck Traffic
- Emission Rate Trends**
- PM<sub>2.5</sub> Background Concentrations**


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### Emission Rate Trends

Forecast Trends in PM<sub>2.5</sub> Emission Rates – Fairfax County

Year	Light Duty Vehicles	Buses	Trucks
2005	~1.5	~1.5	~1.5
2010	~1.0	~1.0	~1.0
2015	~0.8	~0.8	~0.8
2020	~0.6	~0.6	~0.6
2025	~0.5	~0.5	~0.5
2030	~0.4	~0.4	~0.4
2035	~0.3	~0.3	~0.3
2040	~0.2	~0.2	~0.2

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### EPA Conformity Rule / Guidance Examples

**(Highway / Intersection)**

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(i) and (ii) are:

- A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic;
- New exit ramps and other highway facility improvements to connect a highway or expressway to a major freight, bus, or intermodal terminal;
- Expansion of an existing highway or other facility that affects a congested intersection (operated at Level-of-Service D, E, or F) that has a significant increase in the number of diesel trucks; and,
- Similar highway projects that involve a significant increase in the number of diesel transit buses and/or diesel trucks


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### PM<sub>2.5</sub> Assessment Criteria Intersections

Intersection (Channelization, Circles, Roundabouts, Signalization)  
or Interchange Reconfiguration

<p>Is the project required to either increase the Level-of-Service (LOS) for intermodal operating at D, E or F with significant diesel AADTT or increase a significant increase in diesel AADTT related to the project, but significant intermodal LOS to D, E or F?</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">No</td> <td style="width: 50%; text-align: center;">Yes</td> </tr> <tr> <td style="padding: 5px;"> <p>In the opening year diesel AADTT at or below the threshold listed above for New Highway Construction or, in the increase in diesel AADTT (if any) less than or equal to the threshold specified above for highway Capacity Expansion?</p> </td> <td style="padding: 5px;"> <p>Clearly Not a Project of Air Quality Concern</p> </td> </tr> <tr> <td style="padding: 5px;"> <p>Clearly Not a Project of Air Quality Concern</p> </td> <td style="padding: 5px;"> <p>Additional Review Required</p> </td> </tr> </table>	No	Yes	<p>In the opening year diesel AADTT at or below the threshold listed above for New Highway Construction or, in the increase in diesel AADTT (if any) less than or equal to the threshold specified above for highway Capacity Expansion?</p>	<p>Clearly Not a Project of Air Quality Concern</p>	<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>
No	Yes						
<p>In the opening year diesel AADTT at or below the threshold listed above for New Highway Construction or, in the increase in diesel AADTT (if any) less than or equal to the threshold specified above for highway Capacity Expansion?</p>	<p>Clearly Not a Project of Air Quality Concern</p>						
<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>						

Diesel trucks are subset of FHWA's Class 4-13 vehicle types  
 EPA/FHWA Guidance provides guidance of new roadway of concern = 125,000 AADT and 8% trucks

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### PM<sub>2.5</sub> Assessment Criteria New Highway Construction

<p>Is the opening year diesel average daily truck traffic (AADTT)** less than or equal to 50,000+12?</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">No</td> <td style="width: 50%; text-align: center;">Yes</td> </tr> <tr> <td style="padding: 5px;"> <p>Clearly Not a Project of Air Quality Concern</p> </td> <td style="padding: 5px;"> <p>Additional Review Required</p> </td> </tr> </table>	No	Yes	<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>
No	Yes				
<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>				

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### EPA Conformity Rule / Guidance Examples

**(Transit / Intermodal)**

Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(iii) and (iv) are:

- A major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.101<sup>2</sup>; and,
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by bus arrivals.

Examples of projects that are not a local air quality concern under 40 CFR 93.123(b)(1)(iii) and (iv) would be:

- A new or expanded bus terminal that is serviced by non-diesel vehicles (e.g., compressed natural gas) or hybrid-electric vehicles; and,
- A 50% increase in daily arrivals at a small terminal (e.g., a facility with 10 buses in the peak hour).

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### PM<sub>2.5</sub> Assessment Criteria Highway Capacity Expansion

<p>Is the increase in diesel AADTT (if any) for the opening year build scenario less than or equal to 20% of the threshold listed above for New Highway Construction?</p>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; text-align: center;">No</td> <td style="width: 50%; text-align: center;">Yes</td> </tr> <tr> <td style="padding: 5px;"> <p>Clearly Not a Project of Air Quality Concern</p> </td> <td style="padding: 5px;"> <p>Is the opening year diesel AADTT at or below the threshold listed above for New Highway Construction?</p> </td> </tr> <tr> <td style="padding: 5px;"> <p>Clearly Not a Project of Air Quality Concern</p> </td> <td style="padding: 5px;"> <p>Additional Review Required</p> </td> </tr> </table>	No	Yes	<p>Clearly Not a Project of Air Quality Concern</p>	<p>Is the opening year diesel AADTT at or below the threshold listed above for New Highway Construction?</p>	<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>
No	Yes						
<p>Clearly Not a Project of Air Quality Concern</p>	<p>Is the opening year diesel AADTT at or below the threshold listed above for New Highway Construction?</p>						
<p>Clearly Not a Project of Air Quality Concern</p>	<p>Additional Review Required</p>						

EPA/FHWA Guidance indicates a "significant increase" in the number of diesel trucks would need to be determined through interagency consultation

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**PM<sub>2.5</sub> Assessment Criteria**  
**Intermodal or Transit Facility for Rail, Bus, or Truck**

**New Intermodal or Transit Facility**

Is the facility not considered to be a "significantly upgraded project" under 40 CFR 93.103?\*

Yes	No
Clearly Not A Project of Air Quality Concern	Additional Review Required

**Expanded Intermodal or Transit Facility**

Will the expanded facility have less than a 10% increase in daily (total) bus/truck arrivals or, for small facilities, a total of less than or equal to 15 (small) bus/trucks in the peak hour of that facility?†

Yes	No
Clearly Not A Project of Air Quality Concern	Does the expanded facility otherwise meet the criteria specified for New Intermodal or Transit Facilities as specified above? Yes   No   Additional Review Required
	Clearly Not A Project of Air Quality Concern   Additional Review Required

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**PM<sub>2.5</sub> Project Assessment Criteria**  
**Discussion**

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## APPENDIX B: REFERENCES AND RESOURCES

B1: Guidance and Regulations

B2: National and VDOT Programmatic Agreements

B3: Resources for Modeling Tools

B4: Resources for Research and Best Practices

## APPENDIX B1: GUIDANCE AND REGULATIONS

**REGULATIONS:**

Agency	Regulation	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	PM <sub>2.5</sub>	MSATS	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
EPA	Clean Air Act (and amendments)	<a href="#">Link</a>	■	■	■	■	■								
	Transportation Conformity Regulations (EPA-420-B-12-013)	<a href="#">Link</a>	■		■			■	■						
	EPA Project-Level Conformity and Hot-Spot Analyses	<a href="#">Link</a>													
	EPA’s Guideline on Air Quality Models	<a href="#">Link</a>	■	■	■					■	■				
	Air Toxics Final Rules	<a href="#">Link</a>					■								
FHWA	FHWA Carbon Monoxide Categorical Hot-Spot Finding	<a href="#">Link</a>	■					■	■						
	FHWA Transportation Planning Requirements and Their Relationship To NEPA Approvals	<a href="#">Link</a>		■		■	■	■	■						
VA	Virginia Regulation for Transportation Conformity (9 VAC 5-151) Note the Virginia regulation reflects the requirements of the federal rule for inter-agency and public consultation	<a href="#">Link</a>	■		■			■	■						
	VDOT Road and Bridge Specifications	<a href="#">Link</a>	■	■	■	■	■								■
	DEQ Air Pollution Regulations 9 VAC 5-130 (Open Burning Restrictions) 9 VAC 5-50 (Fugitive Dust Precautions) 9 VAC 5-5-45 (Asphalt Paving Operations)	<a href="#">Link1</a> <a href="#">Link2</a> <a href="#">Link3</a>	■	■	■	■	■								

**GUIDANCE:**

Agency	Document	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	PM <sub>2.5</sub>	MSATS	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
EPA	Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM <sub>2.5</sub> and PM <sub>10</sub> Nonattainment and Maintenance Areas (EPA-420-B10-040)	<a href="#">Link</a>			■				■	■		■			
	Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA-454/R-92-005)	<a href="#">Link</a>	■	■						■		■			
	Using MOVES in Project-Level Carbon Monoxide Analyses (EPA-420-B-10-041)	<a href="#">Link</a>	■	■							■		■		
FHWA	FHWA Air Quality	<a href="#">Link</a>													
	Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA	<a href="#">Link</a>				■			■	■					
	FHWA Technical Advisory T6640.8A October 30, 1987	<a href="#">Link</a>		■		■	■	■	■	■					
	A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives	<a href="#">Link</a>				■					■				
	Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process (Federal Highway Administration (FHWA), 2003)	<a href="#">Link</a>					■		■	■					
	Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents.	<a href="#">Link</a>				■					■				

## APPENDIX B2: NATIONAL AND VDOT PROGRAMMATIC AGREEMENTS

	Programmatic Agreement Name	Hyperlink	Pollutants					Relevant Content								
			CO – Conf.	CO - NEPA	PM <sub>2.5</sub>	MSATS	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Documentation	
VDOT Agreements	FHWA-VDOT, “Project-Level Carbon Monoxide Air Quality Studies Agreement”, letter agreement executed February 27, 2009.	<a href="#">Link</a>	■	■				■	■							
	FHWA-VDOT, “No-Build Analysis Agreement for Air and Noise Studies”, letter agreement dated May 22, 2009.	<a href="#">Link</a>	■	■						■						
	FHWA-VDOT, “Procedures for Updating Air Studies When New Planning Assumptions Become Available”, letter agreement dated October 28, 2004.	<a href="#">Link</a>	■	■						■						
	FHWA-VDOT, “Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide”, 2016 (Pending)	<a href="#">Link</a>	■	■												■

### APPENDIX B3: RESOURCES FOR MODELING TOOLS

	Modeling Tool Reference	Hyperlink	Pollutants					Relevant Content						
			CO – Conf.	CO - NEPA	PM <sub>2.5</sub>	MSATS	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations
<b>Modeling Tool Resources</b>	EPA’s MOVES Website for Software Download	<a href="#">Link</a>	■	■	■	■				■				
	EPA’s SCRAM Website for Dispersion Model Software Download	<a href="#">Link</a>	■	■	■	■				■				
	FHWA Office of Planning, Environment, & Realty Models and Methodologies	<a href="#">Link</a>	■	■	■	■				■				
	FHWA Resource Center – Air Quality Team References to Interface and Utility Software	<a href="#">Link</a>	■	■	■	■				■				
	NCHRP 25-38 Input Guidelines for MOVES	<a href="#">Link</a>												
	NCHRP 25-48: Combined Interface for Project Level Air Quality Analysis <i>Study Currently Active</i>	<a href="#">Link</a>	■	■	■	■				■				
	Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors, EPA	<a href="#">Link</a>	■	■	■	■					■			■
	NONROAD Model (nonroad engines, equipment, and vehicles), EPA	<a href="#">Link</a>	■	■	■	■				■				

## APPENDIX B4: RESOURCES FOR RESEARCH AND BEST PRACTICES

	Reference / Resource Name	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	PM <sub>2.5</sub>	MSATS	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
Background Information	EPA Greenbook: Nonattainment designations for all criteria pollutants	<a href="#">Link</a>	■		■										
	National Ambient Air Quality Standards	<a href="#">Link</a>	■		■										
	Transportation Conformity (FWHA)	<a href="#">Link</a>	■		■										
	Transportation Conformity (EPA)	<a href="#">Link</a>	■		■										
	FHWA Air Quality Information	<a href="#">Link</a>	■	■	■	■									
	Federal Highway Legislation and Regulations	<a href="#">Link</a>		■		■									
	FHWA’s Resource Center Website (Air Quality Team)	<a href="#">Link</a>	■	■	■	■	■		■	■					
Other Technical Resources	A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives	<a href="#">Link</a>				■			■						
	Virginia Ambient Air Monitoring Data Reports, DEQ Office of Air Quality Monitoring	<a href="#">Link</a>	■	■	■									■	
	EPA Air Data Monitoring Website	<a href="#">Link</a>	■	■	■									■	
	FHWA NEPA Training For Project-Level Air Quality Analyses (provided in VDOT Online Data Repository)	<a href="#">Link</a>	■	■	■	■			■	■	■	■	■	■	■
	Project-Level Training for Quantitative PM Hot-Spot Analyses	<a href="#">Link</a>			■				■		■				
	AASHTO Practitioner’s Handbook: Indirect Effects and Cumulative Impacts Assessments	<a href="#">Link</a>					■		■	■					
	NCHRP Report 466: Desk Reference For Estimating the Indirect Effects of Proposed Transportation Projects	<a href="#">Link</a>					■		■	■					
	Standards and concerns that apply to highway tunnels, FHWA	<a href="#">Link</a>		■					■		■				
	TRB Transportation & Air Quality (ADC20) Project-Level Analyses	<a href="#">Link</a>													
	NCHRP 25-25 Task 70: Assessment of Quantitative Mobile Source Air Toxics in Environmental Documents	<a href="#">Link</a>				■			■	■	■				
	NCHRP 25-25 Task 78: Programmatic Agreements for Project-Level Air Quality Analyses Using MOVES, CAL3QHC/R and AERMOD	<a href="#">Link</a>													
	NCHRP 25-25 Task 89: Establishing Representative Background Concentrations for Quantitative Hot-spot Analyses for Particulate Matter	<a href="#">Link</a>			■							■	■		
	CEQ Memorandum. Guidance on the Consideration of Past Actions in Cumulative Effects Analysis. 6/2005.	<a href="#">Link</a>					■		■	■					

# Project-Level Air Quality Analysis Resource Document

## APPENDIX C: CONFORMITY EXEMPTION TABLES

**Projects Exempt from Project-level and Regional Conformity Analyses**

Federal Conformity Rule, 40 CFR 93.126 - Table 2: Exempt Projects

(<https://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol21/xml/CFR-2013-title40-vol21-sec93-126.xml>)

SAFETY	
<ul style="list-style-type: none"> <li>▪ Railroad/Highway crossing;</li> <li>▪ Hazard elimination program;</li> <li>▪ Safer non-Federal-aid system roads;</li> <li>▪ Shoulder improvements;</li> <li>▪ Increasing sight distance;</li> <li>▪ Safety improvement program;</li> <li>▪ Traffic control devices and operating assistance other than signalization projects;</li> <li>▪ Railroad/highway crossing warning devices;</li> <li>▪ Guardrails, median barriers, crash cushions;</li> </ul>	<ul style="list-style-type: none"> <li>▪ Pavement resurfacing and/or rehabilitation;</li> <li>▪ Pavement marking demonstration;</li> <li>▪ Emergency relief (23 U.S.C. 125);</li> <li>▪ Fencing;</li> <li>▪ Skid treatments;</li> <li>▪ Safety roadside rest areas;</li> <li>▪ Adding medians;</li> <li>▪ Truck climbing lanes outside the urbanized area;</li> <li>▪ Lighting improvements;</li> <li>▪ Widening narrow pavements or reconstructing bridges (no additional travel lanes);</li> <li>▪ Emergency truck pullovers</li> </ul>
MASS TRANSIT	
<ul style="list-style-type: none"> <li>▪ Operating assistance to transit agencies.</li> <li>▪ Purchase of support vehicles;</li> <li>▪ Rehabilitation of transit vehicles <sup>1</sup></li> <li>▪ Purchase of office, shop, and operating equipment for existing facilities;</li> <li>▪ Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.);</li> <li>▪ Construction or renovation of power, signal, and communications systems;</li> <li>▪ Construction of small passenger shelters and information kiosks;</li> </ul>	<ul style="list-style-type: none"> <li>▪ Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures);</li> <li>▪ Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way;</li> <li>▪ Purchase of new buses and rail cars to re-place existing vehicles or for minor expansions of the fleet <sup>1</sup>;</li> <li>▪ Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771.</li> </ul>
AIR QUALITY	
<ul style="list-style-type: none"> <li>▪ Continuation of ride-sharing and van-pooling promotion activities at current levels.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Bicycle and pedestrian facilities.</li> </ul>
OTHER	
<ul style="list-style-type: none"> <li>▪ Specific activities which do not involve or lead directly to construction, such as: Planning and technical studies, Grants for training and research programs. Planning activities conducted pursuant to titles 23 and 49 U.S.C., Federal-aid systems revisions.</li> <li>▪ Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action.</li> <li>▪ Noise attenuation.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Emergency or hardship advance land acquisitions (23 CFR 710.503);</li> <li>▪ Acquisition of scenic easements;</li> <li>▪ Plantings, landscaping, etc;</li> <li>▪ Sign removal;</li> <li>▪ Directional and informational signs;</li> <li>▪ Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities);</li> <li>▪ Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, location or capacity changes.</li> </ul>

(1) In PM<sub>2.5</sub>/ PM<sub>10</sub> nonattainment or maintenance areas, such projects are exempt only if they are in compliance with control measures in the applicable implementation plan.

**Additional Projects Exempt from Regional Level Conformity Only**

Federal Conformity Rule, 40 CFR 93.127 – Table 3: Projects Exempt From Regional Emissions Analyses.  
(<https://www.gpo.gov/fdsys/pkg/CFR-2012-title40-vol21/xml/CFR-2012-title40-vol21-sec93-127.xml>)

- Intersection channelization projects.
- Intersection signalization projects at individual intersections.
- Interchange reconfiguration projects.
- Changes in vertical and horizontal alignment.
- Truck size and weight inspection stations.
- Bus terminals and transfer points.

## APPENDIX D: DATA FOR LEVEL OF ANALYSIS DETERMINATION

D1: Project Data Needs for PM<sub>2.5</sub> Level of Analysis Determination

D2: Project Data Needs for CO Level of Analysis Determination

D3: Project Data Needs for MSATs Level of Analysis Determination

**APPENDIX D1: DATA NEEDS FOR PM<sub>2.5</sub> LEVEL OF ANALYSIS DETERMINATION**

Data
<ul style="list-style-type: none"> <li>▪ Type of project improvement including any major developments or intermodal facilities (especially those resulting in increased diesel truck traffic) linked to the improvement.</li> <li>▪ Opening and Design Year Average Daily Traffic (ADT) and Average Daily Truck Traffic (ADTT) (or truck percent) at highest volume location in study area. If available, obtain information on No-Build and Build scenario impacts of project for the year(s) of peak emissions. If project-specific analyses are not available for the study, then data from the Highway Performance Monitoring System (HPMS) may be used.</li> <li>▪ If available, traffic analyses indicating No-Build and Build Level of Service (LOS) at high volume intersections and/or interchanges</li> <li>▪ Information on relevant intermodal terminals including peak hour arrivals for trucks and buses.</li> </ul>

**APPENDIX D2: DATA NEEDS FOR CO LEVEL OF ANALYSIS DETERMINATION**

Data	Typical Sources
Type of project improvement	<ul style="list-style-type: none"> <li>▪ Project description</li> </ul>
No-Build and Build Average Daily Traffic (ADT) for design year at worst-case intersection locations	<ul style="list-style-type: none"> <li>▪ Traffic analyses and forecasts conducted for study (e.g. modeling or simulation)</li> <li>▪ Regional travel modeling</li> </ul>
No-Build and Build Level of Service (LOS) for design year at worst-case intersection locations	<ul style="list-style-type: none"> <li>▪ Traffic analyses and forecasts conducted for study (modeling, simulation, Highway Capacity Manual analyses)</li> <li>▪ Other post processing methodologies employing principles from the Highway Capacity Manual.</li> </ul>
Proposed intersection skew angles	<ul style="list-style-type: none"> <li>▪ Intersection design</li> </ul>

**APPENDIX D3: DATA NEEDS FOR MSATS LEVEL OF ANALYSIS DETERMINATION**

<b>Data</b>	<b>Typical Sources</b>
Type of project improvement including any major developments or intermodal facilities linked to the improvement.	<ul style="list-style-type: none"><li>▪ Project description.</li></ul>
Design Year No-Build and Build ADT at highest volume location in study area.	<ul style="list-style-type: none"><li>▪ Traffic analyses and forecasts conducted for study (modeling, simulation, Highway Capacity Manual analyses)</li></ul>
Proximity of project to populated areas.	<ul style="list-style-type: none"><li>▪ Project Aerials or Google Earth imagery.</li><li>▪ GIS land cover maps</li></ul>

## APPENDIX E: INPUT DATA SOURCES FOR MOVES MODELING

E1: Input Data Sources for CO MOVES Modeling

E2: Input Data Sources for PM<sub>2.5</sub> MOVES Modeling

E3: Input Data Sources for MSAT MOVES Modeling

## APPENDIX E1: INPUT DATA SOURCES FOR CO MOVES MODELING

MOVES PDM Input	Typical Sources of Information
<p>Links (average speed, traffic volume, length, road type, grade)</p>	<p>Options:</p> <ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/ planning staff, which may include posted speeds if modeling results for congested speeds are not available, and/or</li> <li>Worst-case volume and speed assumptions (which are listed in <b>Appendix G1</b> with the inputs for the dispersion model CAL3QHC).</li> </ul>
<p>Link Source Type Hour Fraction (distribution among MOVES vehicle types for each link and hour)</p>	<p>Options include but are not limited to:</p> <ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/ planning staff or, if project specific forecasts are limited in detail or coverage, a mix of project-specific forecasts and regional data, e.g., project-specific auto and truck forecasts, with regional data applied to sub-allocate the forecasts to the MOVES source types.</li> <li>“Regional average” estimates obtained from available regional modeling output or may be generated in regional modeling using inputs consistent with regulatory regional analyses, e.g., distribution data obtained from the output of a regional conformity analysis (or regional analysis conducted with inputs consistent with the regional conformity analysis) for the closest or most recent year to the desired modeling year for the project-level analysis, or</li> <li>Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (<a href="http://www.virginiadot.org/info/ct-TrafficCounts.asp">http://www.virginiadot.org/info/ct-TrafficCounts.asp</a>) or the national or periodic emission inventory for the closest or most recent year to the desired modeling year for the project-level analysis.</li> </ul>
<p>Link Drive Schedule (second by second speed inputs for each link; optional)</p>	<ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff.</li> <li><i>Note: Given time and cost considerations, and consistent with Department protocols, project-specific link drive schedules and/or operating mode distributions are not typically applied for highway projects.</i></li> </ul>
<p>Operating Mode Distribution (operating mode fraction data for each link; optional)</p>	
<p>Off-Network Link (vehicles generating starts, extended idling)</p>	<ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff.</li> <li><i>Note: If start and extended idling emissions are determined not to be a significant source of emissions in the project area and are not directly affected by the project, then they may be excluded from the project-level analysis.</i></li> </ul>
<p>Vehicle Age Distribution Fuel Formulation Fuel Supply I/M Parameters Temperatures / Humidity Alternative Vehicle and Fuel Technologies (AVFT)</p>	<ul style="list-style-type: none"> <li>VDOT tabulations, which for consistency are typically compiled from modeling inputs originally developed from regional analyses (e.g., regional conformity analyses and/or emission inventories as available and appropriate).</li> <li>MOVES AVFT default values recommended until such time as region specific values are deemed appropriate, developed, vetted and made available.</li> <li><i>Note: Consistent with Department protocols, worst-case values may be applied at the discretion of the Department for certain inputs.</i></li> </ul>

## APPENDIX E2: INPUT DATA SOURCES FOR PM<sub>2.5</sub> MOVES MODELING

MOVES PDM Input	Typical Sources of Information
Links (average speed, traffic volume, length, road type, grade)	<ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff.</li> </ul>
Link Source Type Hour Fraction (distribution among MOVES vehicle types for each link and hour)	<p>Options include but are not limited to:</p> <ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff or, if project specific forecasts are limited in detail or coverage, a mix of project-specific forecasts and regional data, e.g., project-specific auto and truck forecasts, with regional data applied to sub-allocate the forecasts to the MOVES source types.</li> <li>“Regional average” estimates obtained from available regional modeling output or may be generated in regional modeling using inputs consistent with regulatory regional analyses, e.g., distribution data obtained from the output of a regional conformity analysis (or regional analysis conducted with inputs consistent with the regional conformity analysis) for the closest or most recent year to the desired modeling year for the project-level analysis, or</li> <li>Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (<a href="http://www.virginiadot.org/info/ct-TrafficCounts.asp">http://www.virginiadot.org/info/ct-TrafficCounts.asp</a>) or the national or periodic emission inventory for the closest or most recent year to the desired modeling year for the project-level analysis.</li> </ul>
Link Drive Schedule (second by second speed inputs for each link; optional)	<ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff.</li> </ul>
Operating Mode Distribution (operating mode fraction data for each link; optional)	<ul style="list-style-type: none"> <li><i>Note: Given time and cost considerations, and consistent with Department protocols, project-specific link drive schedules and/or operating mode distributions are not typically developed or applied for highway projects.</i></li> </ul>
Off-Network Link (vehicles generating starts, extended idling)	<ul style="list-style-type: none"> <li>Project-specific data and forecasts provided by traffic engineering/planning staff.</li> <li><i>Note: If start and extended idling emissions are determined not to be a significant source of emissions in the project area and are not directly affected by the project, then they may be excluded from the project-level analysis</i></li> </ul>
Vehicle Age Distribution Fuel Formulation Fuel Supply I/M Parameters Temperatures / Humidity Alternative Vehicle and Fuel Technologies (AVFT)	<ul style="list-style-type: none"> <li>VDOT tabulations, which for consistency are typically compiled from modeling inputs originally developed from regional analyses (e.g., regional conformity analyses and/or emission inventories as available and appropriate).</li> <li>MOVES AVFT default values recommended until such time as region specific values are deemed appropriate, developed, vetted and made available.</li> </ul>

## APPENDIX E3: INPUT DATA SOURCES FOR MSAT MOVES MODELING

MOVES CDM Input	Typical Sources of Information and Preparation Methods
HPMS VMT Vehicle Type/Year	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data for the affected network links (as defined in <b>Section 4.5.1</b>).</li> <li>▪ Project-specific data typically includes a subset of available regional travel demand model outputs (as used for a regional conformity analysis) or other travel demand modeling such as a “sub-area analysis” undertaken specifically for a project.</li> </ul> <p><b>Other Options (Supplemental or in Absence of Project-Specific Data)</b></p> <ul style="list-style-type: none"> <li>▪ Regional traffic data as available from VDOT or other traffic count sources to expand model VMT totals to the annual (or daily) VMT inputs to MOVES or to disaggregate VMT to the MOVES input vehicle classes.</li> <li>▪ Regional air quality conformity and/or periodic emission inventory input data to support disaggregation of VMT to MOVES input vehicle classes.</li> </ul>
Average Speed Distribution	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data for the affected network links (as defined in <b>Section 4.5.1</b>).</li> <li>▪ Project-specific data typically includes a subset of available regional travel demand model outputs (as used for a regional conformity analysis) or other travel demand modeling such as a “sub-area analysis” undertaken specifically for a project.</li> <li>▪ Preferred methods include travel model post processing procedures to estimate congested speeds by time period and to support the input formats needed by MOVES.</li> <li>▪ Other spreadsheet approaches may be used to develop the MOVES Average Speed Distribution file. Processes typically include calculation of the VHT per link (link distance x volume / congested speed), assignment of VHT to appropriate MOVES speed bins, summing of VHT by speed bin, and calculation of distributions by facility type.</li> </ul> <p><b>Other Options (Supplemental or in Absence of Project-Specific Data)</b></p> <ul style="list-style-type: none"> <li>▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation.</li> </ul>

<p>Road Type Distribution</p>	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data for the affected network links (as defined in <b>Section 4.5.1</b>).</li> <li>▪ Project-specific data typically includes a subset of available regional travel demand model outputs (as used for a regional conformity analysis) or other travel demand modeling such as a “sub-area analysis” undertaken specifically for a project.</li> </ul> <p><b>Other Options (Supplemental or in Absence of Project-Specific Data)</b></p> <ul style="list-style-type: none"> <li>▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation.</li> <li>▪ Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (<a href="http://www.virginia.gov/info/ct-TrafficCounts.asp">http://www.virginia.gov/info/ct-TrafficCounts.asp</a>).</li> </ul>
<p>Ramp Fractions</p>	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data for the affected network links (as defined in <b>Section 4.5.1</b>).</li> <li>▪ Project-specific data typically includes a subset of available regional travel demand model outputs (as used for a regional conformity analysis) or other travel demand modeling such as a “sub-area analysis” undertaken specifically for a project.</li> </ul> <p><b>Other Options (Supplemental or in Absence of Project-Specific Data)</b></p> <ul style="list-style-type: none"> <li>▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation.</li> <li>▪ MOVES default values (i.e. 8% of restricted road VHT)</li> </ul>
<p>Monthly VMT Distribution Daily VMT Distribution Hourly VMT Fraction</p>	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data for the affected network links (as defined in <b>Section 4.5.1</b>).</li> <li>▪ Preferred data sources can include regional air quality conformity and/or periodic emission inventory input data.</li> </ul> <p><b>Other Options (Supplemental or in Absence of Project-Specific Data)</b></p> <ul style="list-style-type: none"> <li>▪ MOVES emission model defaults</li> </ul>

<p>Source Type Population</p>	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ Important for start and evaporative emissions; however, these emissions are <u>not</u> used in MSAT analysis, but this input needed for a MOVES to run.</li> <li>▪ Per guidance and FHWA training materials referenced in <b>Section 4.5</b>, utilize project-specific data if available, otherwise MOVES defaults may be estimated per FHWA training material methods.</li> <li>▪ Regional air quality conformity and/or periodic emission inventory input data.</li> </ul>
<p>Vehicle Age Distribution                      Fuel Formulation                      Fuel Supply                      I/M Parameters                      Temperatures/Humidity                      Alternative Vehicle and Fuel Technologies (AVFT)</p>	<p><b>Preferred Data Source</b></p> <ul style="list-style-type: none"> <li>▪ VDOT tabulations, which for consistency are typically compiled from modeling inputs originally developed from regional analyses (e.g, regional conformity analyses and/or emission inventories as available and appropriate).</li> <li>▪ MOVES AVFT default values recommended until such time as region specific values are deemed appropriate, developed, vetted and made available.</li> </ul>

# Project-Level Air Quality Resource Document

## APPENDIX F: LOCAL REGIONAL CONFORMITY AND SIP DATA FOR MOVES EMISSION MODEL

F1: Northern Virginia MOVES Data

F2: Virginia Remaining State MOVES Data

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## APPENDIX F1: DEFAULT MOVES INPUTS FOR NORTHERN VIRGINIA

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<b>Data Source*:</b>	MWCOG Regional Conformity Files (2015 CLRP and FY2015-2020 TIP) and the 2011 National Emission Inventory (NEI) in MOVES2014 format
<b>Years:</b>	2011, 2015, 2017, 2025, 2030, 2040
<b>File Formats:</b>	County Data Manager (CDM) Inputs in CSV format
<b>File Download Link:</b>	<a href="http://www.virginiadot.org/programs/pr-environmental.asp">http://www.virginiadot.org/programs/pr-environmental.asp</a> <a href="http://outsidevdot.cov.virginia.gov">http://outsidevdot.cov.virginia.gov</a> Registration Required

*\* Files prepared for the most recent regional conformity analysis, national emission inventory, SIP development, or other regional analysis may also be selected based on availability and as appropriate for the project-level air quality analysis, as long as the selection is consistent with federal regulations and as appropriate guidance.*

*\* EPA's approval of the MOVES2014 emissions model for SIPs and transportation conformity analyses was effective October 7, 2014. This approval started a two-year transportation conformity grace period that ends on October 7, 2016, after which MOVES2014 is required to be used for new transportation conformity analyses<sup>28</sup>. Before the end of the grace period, either MOVES2010a/b or MOVES2014 emissions model version may be used for project-level conformity analyses.*

*\* EPA has recently released the MOVES2014a model<sup>29</sup>. This version has not been used for transportation conformity or SIP analyses at this time. MOVES2014a does not significantly change the criteria pollutant emissions results of MOVES2014 and therefore is not considered a new model for SIP and transportation conformity purposes. Use of the model for project-level analyses is optional.*

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<sup>28</sup> <http://www.gpo.gov/fdsys/pkg/FR-2014-10-07/pdf/2014-23258.pdf>

<sup>29</sup> <http://www3.epa.gov/otaq/models/moves/index.htm>

MOVES Local Data from Conformity Runs			
MOVES PDM Input	Description	Key Fields	Data Availability and Inputs Preparation
Vehicle Age Distribution	Provides the distribution of vehicles by age for each calendar year and vehicle type	<ul style="list-style-type: none"> <li>• SourceTypeID</li> <li>• YearID</li> <li>• AgeID</li> <li>• AgeFraction</li> </ul>	<ul style="list-style-type: none"> <li>• Available years:                             <ul style="list-style-type: none"> <li>- 2011, 2015, 2017, 2025, 2030, 2040 (for both PM and CO analyses)</li> </ul> </li> <li>• Data modification for other years:                             <ul style="list-style-type: none"> <li>- Age distribution inputs vary by year. To borrow inputs from the closest available year, data in the "YearID" field should be updated to reflect the calendar year being modeled.</li> <li>- &lt;Optional&gt; EPA provides an age distribution projection tool for MOVES2014 (EPA Tools for MOVES website:<a href="http://www.epa.gov/otaq/models/moves/tools.htm">http://www.epa.gov/otaq/models/moves/tools.htm</a>). The tool creates projections of future year age distributions based on current local age distributions. While MWCOG does not currently use this new tool for conformity purposes, it may still be applied in analyses by and/or for the Department consistent with EPA guidance.</li> </ul> </li> </ul>
Fuel Supply	Provides fuel properties	<ul style="list-style-type: none"> <li>• CountyID</li> <li>• FuelYearID</li> <li>• MonthGroupID</li> <li>• FuelFormulationID</li> <li>• MarketShare</li> <li>• MarketShareCV</li> </ul>	<ul style="list-style-type: none"> <li>• Available years:                             <ul style="list-style-type: none"> <li>- 2011, 2015, 2017, 2025, 2030, 2040</li> </ul> </li> <li>• Fuel inputs for 2015 are to be used for years between 2012 and 2016; fuel inputs for 2017 are to be used for years between 2017 and 2024, fuel inputs for 2025 are to be used for years between 2025 and 2029, fuel inputs for 2030 are to be used for years between 2030 and 2039, fuel inputs for 2040 are to be used for year 2040 and beyond. The "FuelYearID" in the fuel supply and fuel usage fraction input tables need to be updated based on the analysis year.</li> </ul>
Fuel Formulation		<ul style="list-style-type: none"> <li>• FuelFormulationID</li> <li>• FuelSubTypeID</li> <li>• RVP</li> <li>• SulfurLevel</li> <li>• ETOHVolume</li> <li>• MTBEVolume</li> <li>• ETBEVolume</li> <li>• TAMEVolume</li> </ul>	
Fuel Usage Fraction		<ul style="list-style-type: none"> <li>• CountyID</li> <li>• FuelYearID</li> <li>• ModelYearGroupID</li> <li>• SourceBinFuelTypeID</li> <li>• FuelSupplyFuelTypeID</li> <li>• UsageFraction</li> </ul>	

I/M Programs	Provides I/M program parameters	<ul style="list-style-type: none"> <li>• polProcessID</li> <li>• countyID</li> <li>• yearID</li> <li>• sourceTypeID</li> <li>• fuelTypeID</li> <li>• IMProgramID</li> <li>• inspectFreq</li> <li>• testStandardsID</li> <li>• begModelYearID</li> <li>• endModelYearID</li> <li>• useIMyn</li> <li>• complianceFactor</li> </ul>	<ul style="list-style-type: none"> <li>• Available years: <ul style="list-style-type: none"> <li>- 2011, 2015, 2017, 2020, 2025, 2030, 2040</li> </ul> </li> <li>• Data modification for other years: <ul style="list-style-type: none"> <li>- For years beyond 2015, use 2015 IM input table as a base.</li> <li>- Update "YearID" field with the calendar year to be modeled (e.g. 2017).</li> <li>- Select records with "endModelYearID" greater than 1995.</li> <li>- Update "endModelYearID" to be ("YearID"-4)</li> </ul> </li> </ul>
Meteorology	Provides temperatures and humidity inputs	<ul style="list-style-type: none"> <li>• MonthID</li> <li>• ZoneID</li> <li>• HourID</li> <li>• Temperature</li> <li>• RelHumidity</li> </ul>	<ul style="list-style-type: none"> <li>• Available years: <ul style="list-style-type: none"> <li>- 2011 and future years</li> </ul> </li> <li>• Inputs modification: no modification is required for using inputs from available years.</li> </ul>
Source Type Population	Supplemental source for estimating link source type hour fraction inputs (see App.E1-E3)	<ul style="list-style-type: none"> <li>• YearID</li> <li>• SourceTypeID</li> <li>• SourceTypePopulation</li> </ul>	<ul style="list-style-type: none"> <li>• May serve as a supplemental source (in combination with regional VDOT traffic data) to estimate link source type hour fraction inputs in cases where preferred inputs listed in App.E1-E3 are not available, particularly for projects for which emissions from truck and bus traffic are not the primary issue.</li> <li>• The role of the data would be to disaggregate known traffic categories determined from VDOT data sources into the 13 MOVES source types. An optional spreadsheet tool has been developed to assist with calculations and is provided in the online data repository (under the "LinkSourceType_Calculation" folder)</li> </ul>

## APPENDIX F2: DEFAULT MOVES INPUTS FOR VIRGINIA (EXCLUDING NORTHERN VIRGINIA)

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<b>Data Source*:</b>	VDEQ Files for the most recent National Emission Inventory (NEI)
<b>Year:</b>	2011
<b>File Formats:</b>	County Data Manager (CDM) Inputs in CSV Format
<b>File Download Link:</b>	<a href="http://www.virginiadot.org/programs/pr-environmental.asp">http://www.virginiadot.org/programs/pr-environmental.asp</a> <a href="http://outsidevdot.cov.virginia.gov">http://outsidevdot.cov.virginia.gov</a> Registration Required

*\* As of the date of preparation of this report, no jurisdictions outside of northern Virginia are subject to federal conformity requirements for pollutants for which project-level air quality analyses would be needed. Therefore, files prepared for the most recent national emission inventory are typically the primary reference source, although other regional analyses (if any) may also be selected based on availability and as appropriate for the project-level air quality analysis and as long as the selection is consistent with federal regulations and as appropriate guidance.*

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MOVES Local Data from NEI			
MOVES PDM Input	Description	Key Fields	Data Availability and Inputs Preparation
Vehicle Age Distribution	Provides the distribution of vehicles by age for each calendar year and vehicle type	<ul style="list-style-type: none"> <li>• SourceTypeID</li> <li>• YearID</li> <li>• AgeID</li> <li>• AgeFraction</li> </ul>	<ul style="list-style-type: none"> <li>• Available years:                             <ul style="list-style-type: none"> <li>- 2011</li> </ul> </li> <li>• Data modification for other years:                             <ul style="list-style-type: none"> <li>- Age distribution inputs vary by year. To borrow inputs from the closest available year, data in the "YearID" field should be updated to reflect the calendar year being modeled.</li> <li>- EPA provides age distribution projection tool for MOVES2014 (EPA Tools for MOVES website: <a href="http://www.epa.gov/otaq/models/moves/tools.htm">http://www.epa.gov/otaq/models/moves/tools.htm</a>). The tool creates projections of future year age distribution based on current local age distributions.</li> </ul> </li> </ul>
Fuel Supply	Provides fuel properties	<ul style="list-style-type: none"> <li>• CountyID</li> <li>• FuelYearID</li> <li>• MonthGroupID</li> <li>• FuelFormulationID</li> <li>• MarketShare</li> <li>• MarketShareCV</li> </ul>	<ul style="list-style-type: none"> <li>• Fuel inputs are available for MOVES2014 input format.</li> <li>• Available years:                             <ul style="list-style-type: none"> <li>- 2011</li> </ul> </li> </ul>
Fuel Formulation		<ul style="list-style-type: none"> <li>• FuelFormulationID</li> <li>• FuelSubtypeID</li> <li>• RVP</li> <li>• SulfurLevel</li> <li>• ETOHVolume</li> <li>• MTBEVolume</li> <li>• ETBEVolume</li> <li>• TAMEVolume</li> </ul>	
I/M Programs	Provides I/M program parameters	<ul style="list-style-type: none"> <li>• polProcessID</li> <li>• countyID</li> <li>• yearID</li> <li>• sourceTypeID</li> <li>• fuelTypeID</li> <li>• IMProgramID</li> <li>• inspectFreq</li> <li>• testStandardsID</li> <li>• begModelYearID</li> <li>• endModelYearID</li> <li>• useIMyn</li> <li>• complianceFactor</li> </ul>	<ul style="list-style-type: none"> <li>• Available years:                             <ul style="list-style-type: none"> <li>- 2011</li> </ul> </li> <li>• Data modification for other years:                             <ul style="list-style-type: none"> <li>- For years beyond 2011, use 2011 IM input table as a base.</li> <li>- Update "YearID" field with the calendar year to be modeled (e.g. 2017).</li> <li>- Select records with "endModelYearID" greater than 1995 and "useimyn" is "Y".</li> <li>- Update "endModelYearID" to be ("YearID" - 4)</li> </ul> </li> <li>• If a county does not have IM programs in place, no input data will be provided in the IM input file for that county.</li> </ul>

<p>Meteorology</p>	<p>Provides temperatures and humidity inputs</p>	<ul style="list-style-type: none"> <li>• MonthID</li> <li>• ZoneID</li> <li>• HourID</li> <li>• Temperature</li> <li>• RelHumidity</li> </ul>	<ul style="list-style-type: none"> <li>• Available years:             <ul style="list-style-type: none"> <li>- 2011 (for PM analysis only)</li> </ul> </li> <li>• Inputs modification: no modification is required for using inputs from available years.</li> </ul>
<p>Source Type Population</p>	<p>Supplemental source for estimating link source type hour fraction inputs (see App.E1-E3)</p>	<ul style="list-style-type: none"> <li>• YearID</li> <li>• SourceTypeID</li> <li>• SourceTypePopulation</li> </ul>	<ul style="list-style-type: none"> <li>• May serve as a supplemental source (in combination with regional VDOT traffic data) to estimate link source type hour fraction inputs in cases where preferred inputs listed in App.E1-E3 are not available, particularly for projects for which emissions from truck and bus traffic are not the primary issue.</li> <li>• The role of the data would be to disaggregate known traffic categories determined from VDOT data sources into the 13 MOVES source types. An optional spreadsheet tool has been developed to assist with calculations and is provided in the online data repository (under the "LinkSourceType_Calculation" folder)</li> </ul>

# Project-Level Air Quality Resource Document

## APPENDIX G: DEFAULT DATA FOR PROJECT-LEVEL ANALYSIS

G1: CAL3QHC Default Worst Case Parameters

G2: CO Persistence Factor Calculation

G3: Dispersion Model Defaults for PM Analyses

## APPENDIX G1: CAL3QHC DEFAULT WORST CASE PARAMETERS

The following parameters are consistent with applicable EPA and US DOT guidance and represent conservative, worst-case, conditions that tend to over-estimate traffic volumes, emissions and therefore ambient concentrations. The inputs listed below may be adjusted at the discretion of the Department for a specific analysis to better reflect local conditions.

CAL3QHC Parameters	Typical Worst-Case Analysis Inputs																		
<p><b>Emission Factor</b></p>	<ul style="list-style-type: none"> <li>▪ Emission factors are typically developed using the EPA guidance and model resources provided in <b>Appendix B1-B3</b>. Emission factors are developed for free-flow and queueing links, as appropriate for the project.</li> <li>▪ To support screening-level analyses, assumed travel speeds input to EPA’s MOVES emission model for emission factor calculations are as follows:               <ul style="list-style-type: none"> <li>▪ Queueing Links (Idling) = 0 mph</li> <li>▪ Free-flow Links can be estimated using the options provided below:                   <ul style="list-style-type: none"> <li>– Posted speed limit</li> <li>– Methods based on the current version of the Highway Capacity Manual (HCM)</li> <li>– Methods provided in EPA’s Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA-454/R-92-005) as referenced in <b>Appendix B1</b>.</li> <li>– <i>Alternative Worst-Case Approach</i>: Value for speed that would result in an emission factor that would be higher than that for the expected speed, based on typical curves for CO emission factors versus speed.</li> </ul> </li> </ul> </li> <li>▪ The figure below illustrates typical variances of CO emission factors by vehicle speed. The chart is based on national default runs using EPA’s MOVES2014 emission model.</li> </ul> <div style="text-align: center;"> <table border="1" style="margin: 10px auto;"> <caption>Approximate data points from the MOVES2014 CO Emission Rate vs. Speed graph</caption> <thead> <tr> <th>Speed (mph)</th> <th>Emission Rate (g/mi)</th> </tr> </thead> <tbody> <tr><td>5</td><td>17.5</td></tr> <tr><td>10</td><td>8.0</td></tr> <tr><td>20</td><td>6.0</td></tr> <tr><td>30</td><td>5.5</td></tr> <tr><td>40</td><td>5.2</td></tr> <tr><td>50</td><td>5.0</td></tr> <tr><td>60</td><td>5.0</td></tr> <tr><td>70</td><td>5.5</td></tr> </tbody> </table> </div>	Speed (mph)	Emission Rate (g/mi)	5	17.5	10	8.0	20	6.0	30	5.5	40	5.2	50	5.0	60	5.0	70	5.5
Speed (mph)	Emission Rate (g/mi)																		
5	17.5																		
10	8.0																		
20	6.0																		
30	5.5																		
40	5.2																		
50	5.0																		
60	5.0																		
70	5.5																		

<b>Surface Roughness Coefficient (cm)</b>	<ul style="list-style-type: none"> <li>▪ Urban = 108 (consistent with FHWA CO Categorical Hot-Spot Finding)</li> <li>▪ Rural = 11 (grass)</li> <li>▪ For specific roughness, users can refer to EPA’s CAL3QHC Guideline (see <b>Appendix B1</b>).</li> </ul>
<b>Wind Speed (meters per second)</b>	1.0
<b>Wind Direction Increments (degrees, multipliers)</b>	10 (1-36) (or more detailed)
<b>Stability Class</b>	<ul style="list-style-type: none"> <li>▪ Urban Areas: 4 (D-Neutral)</li> <li>▪ Rural Areas: 5 (E)</li> </ul>
<b>Mixing Height (meters)</b>	1000
<b>Setting Velocity (cm/s)</b>	0
<b>Deposition Velocity (cm/s)</b>	0
<b>Median Width (ft)</b>	<ul style="list-style-type: none"> <li>▪ Streets: 0</li> <li>▪ Freeways: 3 (or a minimum distance for a barrier).</li> </ul>
<b>Source Height (ft)</b>	0
<b>Receptor Height(ft)</b>	5.9
<b>Receptor Locations</b>	<p>Following applicable guidance for spacing, but with distance from the traveled roadway as follows for worst-case analyses:</p> <ul style="list-style-type: none"> <li>▪ Typical Worst-Case: Along the right of way edge, with defaults of 10 feet for arterial streets and 20 ft for freeways.</li> <li>▪ More Conservative Worst-Case: Along the edge of the mixing zone (which may be inside the right of way for many highway projects).</li> </ul>
<b>Background Concentration (ppm)</b>	0 (to determine the modeled project contribution to the ambient levels, without background) Note: Background concentrations are tabulated separately (see <b>Appendix H</b> ) and added to the modeled project contribution to get the estimated ambient concentration for comparison to the NAAQS.
<b>Persistence Factor</b>	<p>0.78 default (NOVA)            0.77 default (rest of Virginia)            0.83 maximum (all of Virginia)            See <b>Appendix G2</b> for calculation methodology</p>
<b>Averaging Time (min)</b>	60min

<p><b>Volumes (vehicle per hour) (vph)</b></p>	<p>Default unless project-specific data available. Defaults based on ideal capacity and saturation flow rates from the current edition of the Highway Capacity Manual (HCM) multiplied by number of lanes.</p> <p>Values below based on HCM 2010 version*:</p> <ul style="list-style-type: none"> <li>▪ Freeway = 2400 vehicles per hour per lane (veh/h/ln) times the number of lanes</li> <li>▪ Street = calculate based upon the default saturation flow rate times effective green ratio (effective green time/cycle length = 0.45), times V/C ratio (1.44), times the number of lanes             <ul style="list-style-type: none"> <li>- Metropolitan Areas = 1,230 (veh/h/ln) x number of lanes</li> <li>- Other Areas = 1,130 (veh/h/ln) x number of lanes</li> </ul> </li> </ul> <p><i>* Saturation flow rates from HCM are in passenger car units/h/ln. Values were used to estimate volume in veh/h/ln. See next table entry for data source.</i></p>
<p><b>Saturation Flow Rate (veh/h/ln)</b></p>	<p>Defaults based on saturation flow rates from the current HCM.</p> <p>Values below based on HCM 2010 version (Exhibit 18-28)*:</p> <ul style="list-style-type: none"> <li>▪ 1,900 veh/h/ln (Metropolitan area with population&gt;250,000)</li> <li>▪ 1,750 veh/h/ln (Other than above)</li> </ul> <p><i>* Saturation flow rates from HCM are in passenger car units/h/ln. Values were used to estimate CAL3QHC inputs in veh/h/ln.</i></p>
<p><b>Signal Data</b></p>	<p>Defaults from the current HCM and CAL3QHC software user's guide unless project-specific data available.</p> <p>Per current resources:</p> <ul style="list-style-type: none"> <li>▪ Defaults per HCM 2010 (Exhibit 18-28) and the CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised)):             <ul style="list-style-type: none"> <li>- Signal Type = 1 (pretimed)</li> <li>- Arrival Rate = 3 (average)</li> </ul> </li> <li>▪ Defaults per CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised):             <ul style="list-style-type: none"> <li>- Clearance Lost Time (s) = 2</li> </ul> </li> <li>▪ Worst-case defaults where project-specific information are not available:             <ul style="list-style-type: none"> <li>- Average Cycle Length (s): 120</li> <li>- Average Red Time Length (s): 68</li> </ul> </li> <li>▪ Project specific estimates for Average Cycle Length and Average Red Time Length may also be determined by traffic engineering and/or transportation planning staff using available project data following FHWA's signal timing manual. See: <a href="http://ops.fhwa.dot.gov/publications/fhwahop08024/chapter3.htm">http://ops.fhwa.dot.gov/publications/fhwahop08024/chapter3.htm</a>.</li> </ul>
<p><b>Link Width</b></p>	<ul style="list-style-type: none"> <li>▪ Free flow link width = width of the traveled roadway plus 3 m (10 ft) on each side of the roadway (to account for the mixing zone created by the dispersion of the plume generated by the wake of moving vehicles)</li> <li>▪ Queue link width = the width of the traveled roadway only</li> </ul>

## APPENDIX G2: CO PERSISTENCE FACTOR CALCULATION

The CAL3QHC air quality dispersion model, as used for CO project-level analyses, only predicts 1-hour concentrations. Within the model, a persistence factor is used to estimate an 8-hour concentration from the 1-hour concentration. A default worst case persistence factor has been estimated using 2011-2013 January monitor data per the methods in EPA's 1992 *Guidance for Modeling Carbon Monoxide from Roadway Intersections* (454/R-92-005). The detailed one hour monitor readings, required for the calculation of the persistence factor, were provided by VDEQ for the CO monitor locations in Virginia.

The calculation of the default persistent factor is provided in **Table 1**. The factor is approximated from the monitor data using the following formula:

$$P=T8/T1$$

where:

T1 = the total 1-hour CO concentration

T8 = the total 8-hour CO concentration

The hourly CO monitoring data for each year were used to determine running 8-hour averages (T8) within the month of January. These data were then sorted and used to determine the 10 highest non-overlapping T8 values (as provided in **Table 1**). For each of these 10 non overlapping T8 values, the highest 1-hour (T1) was then determined and used to calculate the appropriate default value for the persistence factor. The 8-hour persistence factor represents the average of the 10 persistence factors calculated. These values were then averaged over all 3 years.

The results show the 3-year average persistence factor is 0.74 for the Arlington monitor site, 0.83 for the Alexandria City site, 0.78 for the Richmond City site, 0.73 for Henrico County site, 0.81 for the Hampton City, 0.75 for the Norfolk City site, and 0.73 for the Roanoke City site.

All monitor sites were averaged to produce an estimated default persistent factor of 0.77 for the state. This value serves as the default persistent factor for CO hotspot analyses for the remaining areas in Virginia.

Table 1: CO Persistence Factor Calculations

Year	Site ID: 510130020 (Arlington County)			Site ID: 515100009 & 515100021 (Alexandria City)*			Site ID: 517600024 (Richmond City)**			Site ID: 510870014 (Henrico County)			Site ID: 516500008 (Hampton City)			Site ID: 517100024 (Norfolk City)			Site ID: 517700015 (Roanoke City)		
	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio	8-Hr	Max 1-Hr	Ratio
2011	1.14	1.40	0.81	1.23	1.70	0.72	0.74	0.90	0.82	0.82	1.40	0.59	0.88	1.00	0.88	0.95	1.20	0.79	0.56	1.40	0.47
	0.7	0.80	0.88	1.08	1.20	0.90	0.71	0.80	0.89	0.89	0.88	0.89	0.68	1.00	0.68	0.91	1.20	0.76	1.3	1.50	0.87
	0.53	0.80	0.66	0.85	0.90	0.94	0.69	0.80	0.86	0.90	0.76	0.76	0.65	1.00	0.65	0.9	1.10	0.82	1.09	1.50	0.73
	0.51	0.90	0.57	0.81	0.90	0.90	0.66	0.80	0.83	0.68	1.10	0.62	0.65	0.70	0.93	0.83	1.30	0.55	1.01	1.20	0.84
	0.45	0.80	0.56	0.8	0.80	1.00	0.61	1.10	0.55	0.67	1.21	0.55	0.63	0.70	0.90	0.72	2.00	0.36	0.88	1.30	0.68
	0.41	0.70	0.59	0.76	0.80	0.95	0.6	0.80	0.75	0.66	0.88	0.75	0.59	0.80	0.74	0.68	1.70	0.40	0.75	1.00	0.75
	0.34	0.60	0.57	0.74	0.80	0.93	0.56	0.70	0.80	0.64	0.88	0.73	0.58	0.60	0.97	0.63	1.20	0.53	0.69	0.90	0.77
	0.31	0.50	0.62	0.71	0.80	0.89	0.54	0.70	0.77	0.63	1.24	0.51	0.54	0.60	0.90	0.6	0.90	0.67	0.68	0.90	0.76
	0.29	0.40	0.73	0.64	0.70	0.91	0.53	0.60	0.88	0.56	0.97	0.58	0.54	0.60	0.90	0.56	1.20	0.47	0.53	0.70	0.76
	0.24	0.40	0.60	0.6	0.70	0.86	0.53	0.60	0.88	0.54	0.86	0.63	0.53	0.60	0.88	0.55	0.70	0.79	0.48	0.80	0.60
2012	Average	0.66		Average	0.90		Average	0.80		Average	0.66		Average	0.84		Average	0.61		Average	0.72	
	1.31	1.60	0.82	1.05	1.40	0.75	1.84	2.00	0.92	1.10	1.26	0.87	0.66	0.80	0.83	0.95	1.50	0.63	0.96	1.40	0.69
	0.98	1.10	0.89	0.8	0.90	0.89	1.31	2.00	0.66	0.95	1.30	0.73	0.55	1.10	0.50	0.59	0.90	0.66	0.86	1.20	0.72
	0.86	1.10	0.80	0.65	0.80	0.81	1.28	1.60	0.80	0.94	1.05	0.90	0.43	0.50	0.86	0.59	0.80	0.74	0.83	1.00	0.83
	0.83	1.00	0.83	0.63	0.90	0.70	0.98	1.60	0.61	0.7	0.80	0.88	0.36	0.40	0.90	0.52	0.60	0.87	0.79	1.10	0.72
	0.7	0.90	0.78	0.61	0.80	0.76	0.74	0.90	0.82	0.68	1.08	0.63	0.31	0.40	0.78	0.46	0.80	0.58	0.78	0.90	0.87
	0.63	0.80	0.79	0.6	0.80	0.75	0.71	1.70	0.42	0.66	0.93	0.71	0.3	0.30	1.00	0.45	0.50	0.90	0.78	1.20	0.65
	0.63	1.10	0.57	0.56	0.60	0.93	0.67	0.80	0.84	0.65	0.75	0.87	0.25	0.30	0.83	0.45	0.60	0.75	0.69	1.20	0.58
	0.61	1.00	0.61	0.54	0.80	0.68	0.61	0.80	0.76	0.62	0.90	0.69	0.24	0.30	0.80	0.44	0.50	0.88	0.63	0.70	0.90
	0.6	0.70	0.86	0.53	0.60	0.88	0.63	0.70	0.90	0.58	0.64	0.91	0.23	0.50	0.46	0.5	0.60	0.83	0.59	0.70	0.84
0.44	0.50	0.88	0.53	0.60	0.85	0.61	0.70	0.87	0.51	0.58	0.88	0.21	0.30	0.70	0.5	0.60	0.83	0.56	1.20	0.47	
2013	Average	0.78		Average	0.80		Average	0.76		Average	0.81		Average	0.77		Average	0.77		Average	0.73	
	0.80	0.90	0.85	1.36	1.60	0.85							0.91	1.10	0.83	1.14	0.80	1.43	0.95	1.30	0.73
	0.69	1.00	0.69	1.33	1.60	0.83							0.9	1.20	0.75	0.96	0.80	1.20	0.94	1.10	0.85
	0.65	0.70	0.93	0.99	1.20	0.83							0.69	0.80	0.86	0.81	0.80	1.01	0.93	1.20	0.78
	0.63	0.70	0.90	0.95	1.30	0.73							0.63	0.80	0.79	0.69	0.80	0.86	0.83	1.00	0.83
	0.60	0.70	0.86	0.9	1.10	0.82							0.6	0.80	0.75	0.63	0.80	0.79	0.68	0.90	0.76
	0.47	0.80	0.59	0.81	1.20	0.68							0.56	0.70	0.80	0.61	0.80	0.76	0.56	0.90	0.62
	0.46	0.50	0.92	0.78	1.20	0.65							0.56	0.60	0.93	0.58	0.80	0.73	0.5	0.70	0.71
	0.45	0.50	0.90	0.75	1.00	0.75							0.54	0.60	0.90	0.54	0.80	0.68	0.48	0.70	0.69
	0.45	0.80	0.56	0.73	0.80	0.91							0.53	0.60	0.88	0.54	0.80	0.68	0.44	0.50	0.88
0.43	0.70	0.61	0.73	1.00	0.73							0.51	0.70	0.73	0.53	0.80	0.66	0.44	0.60	0.73	
2011-2013 Avg	Average	0.74		Average	0.83		Average	0.78		Average	0.73		Average	0.82		Average	0.88		Average	0.76	
	2011-2013 Avg	0.74		2011-2013 Avg	0.83		2011-2013 Avg	0.78		2011-2013 Avg	0.81		2011-2013 Avg	0.81		2011-2013 Avg	0.75		2011-2013 Avg	0.73	
Overall Average (Default Value for Worst-Case Scenario Modeling)																					
3.77																					

\*Note: site ID 515100009 in the City of Alexandria was terminated in August of 2012. A new site (Site ID 515100021) was installed in August 2012.  
 \*\* Note: site ID 517600024 in Richmond City was terminated in December 2012 and a new site (Site ID 517600025) was installed in October 2013. No monitor data was available for 2013 as only January data was used for persistence factor calculations.

### APPENDIX G3: DISPERSION MODEL DEFAULTS FOR PM ANALYSES

CAL3QHCR Parameters	Typical Default Assumptions*
Surface Roughness Coefficient (cm)	3 – 400
Setting Velocity (cm/s)	0
Deposition Velocity (cm/s)	0
Day of Week Pattern	1111111
Traffic Flow	Free Flow
Source Height (ft)	0
Mixing Zone Width (ft)	The width of travelled roadway plus 10 ft on either side
Link Type	As appropriate for the facility.
Hourly Ambient Background Concentration (ppm)	0
Averaging Time (min)	60min

AERMOD Parameters	Typical Default Assumptions*
Modeling Options (MODELOPT keyword)	CONC (calculates concentration values) FLAT (assumes flat terrain)
Pollutant	PM25
Averaging Time	Annual
Receptor Height (m)	1.8
Release Height (m)	1.3 - 1.8
Initial Vertical Dispersion Coefficient (m)	1.2 – 1.7

\* CAL3QHCR and AERMOD default data has been developed from EPA guidance and available FHWA training documents as referenced in **Appendix B1** and **Appendix B4**.

# Project-Level Air Quality Resource Document

## APPENDIX H: BACKGROUND CONCENTRATIONS

H1: Conformity Background Concentration Memo

H2: NEPA Background Concentration Memo

**APPENDIX H1: CONFORMITY BACKGROUND CONCENTRATION MEMO**

**Michael Baker**  
INTERNATIONAL

## MEMORANDUM

**To:** Jim Ponticello, Chris Voigt: VDOT Environmental Division

**From:** Dan Szekeres, Ying-Tzu Chung: Michael Baker Jr., Inc.

**Date:** February 8, 2016

**Subject:** CO and PM<sub>2.5</sub> Background Concentrations for Project-Level Air Quality Modeling  
(For Jurisdictions Subject to Transportation Conformity Requirements in Northern Virginia)

Current background concentrations required for project-level air quality analyses for carbon monoxide (CO) and fine particulate matter (PM<sub>2.5</sub>) are presented in this memorandum. Project-level analyses are conducted to meet the applicable requirements of the federal transportation conformity rule (40 CFR Parts 51 and 93) and apply for the following areas or jurisdictions in Virginia:

- Northern Virginia<sup>1</sup>, i.e., the Virginia portion of the DC-MD-VA maintenance area for the 1997 annual PM<sub>2.5</sub> National Ambient Air Quality Standard (NAAQS).
- The City of Alexandria and the County of Arlington<sup>2</sup>, which are in maintenance for the CO NAAQS.

Background concentrations as presented in this document are typically added to the modeled project contributions to generate estimates of the total concentration for each receptor location modeled. This memorandum and the data and default values it presents may be updated periodically by the Virginia Department of Transportation (VDOT) based on updated data and/or guidance as appropriate.

### Role of Default Background Concentrations

In practice, background concentrations determined based on data from a limited number of ambient monitors apply for relatively broad geographical areas in which multiple transportation projects may be constructed or implemented over time. It is therefore more efficient and cost-effective to determine background concentrations that would apply for all projects located in the same general areas, and subject those "default" values to inter-agency consultation for conformity purposes as appropriate, rather than repeat the process separately for each individual project and area.

### General Approach to Background Concentrations

The default values presented in this memorandum were determined following applicable federal and state requirements and guidance, and the analysis and results subjected to consultation with both VDOT and the

<sup>1</sup> The US EPA Green Book web page (<http://www.epa.gov/airquality/greenbook/>) currently lists the following jurisdictions in Virginia as part of the DC-MD-VA maintenance area for the 1997 annual PM<sub>2.5</sub> NAAQS: Alexandria, Arlington County, Fairfax, Fairfax County, Falls Church, Loudoun County, Manassas, Manassas Park, and Prince William County.

<sup>2</sup> The US EPA Green Book currently lists the following jurisdictions in Virginia as part of the DC-MD-VA maintenance area for the CO NAAQS: Alexandria, and Arlington County.

Virginia Department of Environmental Quality (DEQ). The results of the analysis as well as the methods and procedures are also addressed in the VDOT *Project-Level Air Quality Analysis Resource Document* as appropriate.

A design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS. Design values are defined to be consistent with the individual NAAQS and are typically used to designate and classify nonattainment areas, as well as to assess progress towards meeting the NAAQS. For the 1997 annual  $PM_{2.5}$  NAAQS, design values are based on the 3-year average of annual mean mass concentrations for each eligible monitoring site. For the 1-hour and 8-hour CO NAAQS, design values are based on the 2<sup>nd</sup> maximum mass concentration for the most recent two years<sup>3</sup>. The design value formulations are used as a basis for determining background concentrations.

As an option to be applied at the discretion of the VDOT, alternative values for background concentrations may be determined on a project-specific basis following the general approach outlined in the *Resource Document*. Alternative values may also be determined following updates to EPA guidance and procedures (in consultation with DEQ) even if the updated data and procedures have not yet been incorporated into the Department *Resource Document*. Appropriate documentation of the underlying data and calculation would typically be provided with the analysis in those cases.

#### Monitor Locations and Design Values

This section summarizes the methodology for determining design values using the most recent three-years (2011-2013) of monitor data. DEQ is required by EPA to compile and submit summary information for each SLAMS (State and Local Air Monitoring Station) site that is operated in the state's ambient monitoring network. The Virginia Ambient Air Monitoring 2013 Data Report<sup>4</sup> contains the summary data compiled from monitoring stations and is the primary data source for the Virginia station design values provided in this memo. EPA's Air Data website is also a resource for monitor data to determine background concentrations. The data for CO and  $PM_{2.5}$  can be downloaded from EPA's Air Data website (<http://www.epa.gov/airdata/>) and tabulated for areas in Virginia and nearby monitors in Washington D.C. and Maryland.

Figures 1 and 2 illustrate the monitor locations that have multiple years of monitor data available. These sites were used for the calculation of the background concentrations. Tables 1a to 2b summarize the monitor values for sites in Virginia, Washington D.C., and neighboring counties in Maryland. For CO, the highest second maximum values during the most recent two year period have been summarized in the tables. For  $PM_{2.5}$ , values are estimated by taking the 3-year average of the annual means, consistent with the design value.

All Virginia monitor design values were obtained from DEQ's Virginia Ambient Air Monitoring 2013 Data Report. Some discrepancies exist between DEQ's documented design values and those calculated from EPA's Air Data website as footnoted in the tables. These include differences due to rounding and locations that required a collocated monitor to address incomplete data. For the Arlington County  $PM_{2.5}$  monitor site, incomplete data exists during 2011 due to extensive roof construction at the site. That site has a collocated  $PM_{2.5}$  monitor that was used to replace the primary monitor data during the construction period.

<sup>3</sup> [http://www.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19900618\\_laxton\\_ozone\\_co\\_design\\_value\\_calcs.pdf](http://www.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19900618_laxton_ozone_co_design_value_calcs.pdf)

<sup>4</sup> The latest monitoring reports are available on DEQ's website:  
<http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

Figure 1: Monitor Locations – Regional View

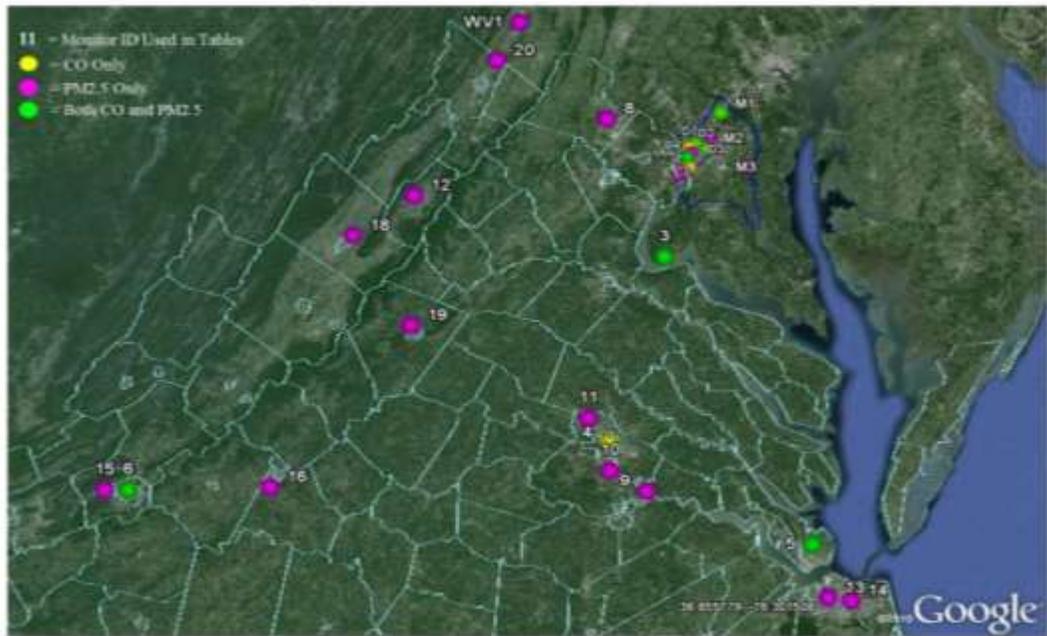
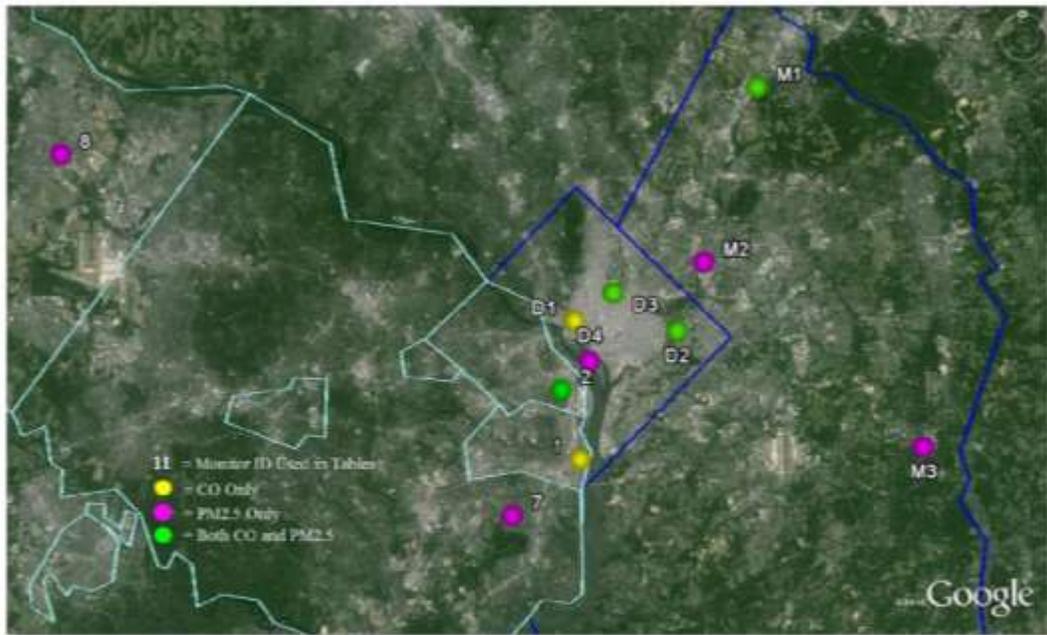


Figure 2: Monitor Locations – Northern Virginia



**Table 1a: CO 2012-2013 Second Maximum Values for Virginia Monitors**

2012-2013 CO Monitoring Data				2012-2013 Highest of Second Max (ppm)	
Site	Region	Site ID	County/City	1-Hour	8-Hour
1	NOVA	51510009*	Alexandria City	1.4	1.0
		515100021*			
2		510130020	Arlington	1.6	1.4
3		510070014	Henrico	1.5	1.2
4	Richmond	517600024**	Richmond City	2.2	1.8
		517600025**			
5	Hampton Roads	516500008	Hampton City	1.1	0.9
		517100024	Norfolk City	2.0	1.1
6	Roanoke	517700015	Roanoke City	1.5	1.2

\* Site ID 51510009 (Alexandria City) was terminated in August 2012 and Site ID 515100021 was installed in August 2012 to serve as a special purpose monitor. Per DEQ email on November 22, 2013, this new site might not be representative of a background concentration due to its relative to the impact of the bus operations for DASH and the public schools. Thus, the 2012-2013 second max values from Site ID 515100021 were not used to determine 2012-2013 highest of second max for Alexandria City.

\*\* Site ID 517600024 (Richmond City) was terminated in December 2012 and site ID 517600025 was installed in October 2013.

**Table 1b: CO 2012-2013 Second Maximum Values for DC-MD Monitors**

2012-2013 CO Monitoring Data				2012-2013 Highest of Second Max (ppm)	
Site	State	Site ID	County/City	1-Hour	8-Hour
D1	DC	110010023	District of Columbia	4.4	2.5
D2		110010041	District of Columbia	2.9	2.5
D3		110010043	District of Columbia	2.4	1.8
M1	MD	240330030	Prince George's	1.2	0.9

**Table 2a: PM<sub>2.5</sub> Design Values for Virginia Monitors**

2011-2013 PM <sub>2.5</sub> Monitor Data				2011-2013 Three Year Average (µg/m3)
Site	Region	Site ID	County/City	Annual
2	NOVA	510130020	Arlington	9.4*
7		510590030	Fairfax	8.0**
8		511071005	Loudoun	8.9
9	Richmond	510360002	Charles	8.2
10		510410003	Chesterfield	8.8
3		510870014	Henrico	8.7
11		510870015	Henrico	8.3**
5	Hampton Roads	516500008	Hampton City	7.9**
13		517100024	Norfolk City	8.7**
14		510100008	Virginia Beach City	8.5
6	Roanoke	517700015	Roanoke City	9.2
15		517750011	Salem City	9.1
16	Other Areas	516800015	Lynchburg City	7.8
17		515200006	Bristol City	9.0
18		511650003	Rockingham	8.9
19		510030001	Albemarle	7.9**
20		510690010	Frederick	9.5
12		511390004	Page	8.1

\* Collocated monitor site

\*\* Rounding differences between DEQ Virginia Ambient Air Monitoring 2013 Data Report and EPA Air Data site

**Table 2b: PM<sub>2.5</sub> Design Values for DC-MD-WV Monitors**

2011-2013 PM <sub>2.5</sub> Monitor Data			2011-2013 Three Year Average (µg/m <sup>3</sup> )	
Site	State	Site ID	County/City	Annual
D2	DC	110010041	District of Columbia	9.8
D4		110010042	District of Columbia	9.4
D3		110010043	District of Columbia	9.7
M2	MD	240330025	Prince George's	10.1
M1		240330030	Prince George's	8.3
M3		240330003	Prince George's	8.1
WV1	WV	540030003	Berkeley	10.7

#### Estimation of Default Background Concentrations

This section summarizes the default background concentrations for CO and PM<sub>2.5</sub> to be used for project-level conformity analyses in Northern Virginia. Per EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM<sub>2.5</sub> and PM<sub>10</sub> Nonattainment and Maintenance Areas Transportation (EPA-420-B-13-053)*, the ambient monitoring data collected at nearby sites is appropriate for estimating background concentrations.

#### Carbon Monoxide (CO)

CO background concentrations for the City of Alexandria and the County of Arlington are needed to support project-level conformity analyses. The maximum design value in Northern Virginia over a two year period (shown in Table 1a) was selected to represent the background concentration for that region. Table 3 summarizes the recommended default background concentrations.

**Table 3: Default CO Background Concentrations for Northern Virginia**

Region	Background Concentration (ppm)	
	2012-2013 Highest of Second Max	
	1-Hour	8-Hour
NOVA (Arlington County and Alexandria City)	1.6	1.4

According to EPA's technical guidance, monitors that are located in directions that are frequently upwind of a project are more likely to represent a project area's background concentration than monitors that are frequently downwind. Based on the 30-year average wind rose data obtained from the Automated Surface Observing System (ASOS), the annual average wind directions in Northern Virginia are primarily blowing from the south and northwest directions. Therefore, the D.C. and Maryland monitors, which are located north or northeast of Northern Virginia, are not considered to be representative of background concentrations in the region.

#### Fine Particulate Matter (PM<sub>2.5</sub>)

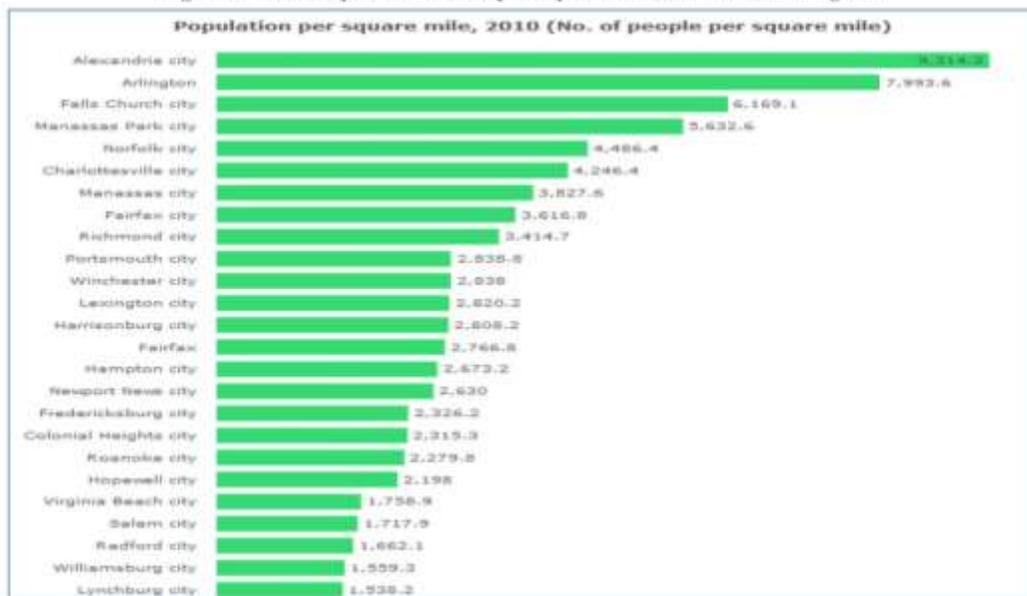
Background concentrations for PM<sub>2.5</sub> are needed to support project-level conformity analyses in Northern Virginia. Table 4 summarizes the recommended default background concentrations for PM<sub>2.5</sub>.

**Table 4: Default PM<sub>2.5</sub> Background Concentrations for Northern Virginia**

Region	Background Concentration (µg/m <sup>3</sup> )
	Annual
Arlington County & Alexandria City	9.4
Remaining Jurisdictions	8.9

A separate PM<sub>2.5</sub> background concentration is identified for the City of Alexandria and the County of Arlington due to the higher monitor reading at the Arlington site, higher land use density (as shown in Figure 3), and each county's proximity to Washington D.C. and its associated monitored values. The remaining counties in Northern Virginia use the Loudoun County monitor data, which is consistent with other monitor sites throughout the state.

**Figure 3: 2010 Population Density– Top 25 Cities/Counties in Virginia**



Source: U.S. Census Bureau  
<http://www.indexmundi.com/>

According to EPA's technical guidance, monitors that are located in directions that are frequently upwind of a project are more likely to represent a project area's background concentration than monitors that are frequently downwind. Based on the 30-year average wind rose data obtained from the Automated Surface Observing System (ASOS), the annual average wind directions in Northern Virginia are primarily blowing from the south and northwest directions. Therefore, the D.C. and Maryland monitors, which are located north or northeast of Northern Virginia, are not considered to be representative of background concentrations in the region. As illustrated in Figure 2, the proximity of the Fairfax and Loudoun County monitor locations are assumed to be representative of the region outside of Arlington and Alexandria City based on the primary wind directions.

**APPENDIX H2: NEPA BACKGROUND CONCENTRATION MEMO**

**Michael Baker**

INTERNATIONAL

## MEMORANDUM

**To:** Jim Ponticello, Chris Voigt: VDOT Environmental Division

**From:** Dan Szekeres, Ying-Tzu Chung: Michael Baker Jr., Inc.

**Date:** February 8, 2016

**Subject:** CO Background Concentrations for Project-Level Air Quality Modeling  
(NEPA Requirements in Virginia)

Current background concentrations as required for project-level NEPA air quality analyses for carbon monoxide (CO) are presented in this memorandum<sup>1</sup>. Background concentrations as presented in this document are typically added to the modeled project contributions to generate estimates of the total concentration for each receptor location modeled. This memorandum and the data and default values it presents may be updated periodically by the Virginia Department of Transportation (VDOT) based on updated data and/or guidance as appropriate.

Role of Default Background Concentrations

In practice, background concentrations determined based on data from a limited number of ambient monitors apply for relatively broad geographical areas in which multiple transportation projects may be constructed or implemented over time. It is therefore more efficient and cost-effective to determine background concentrations that would apply for all projects located in the same general areas rather than repeat the process separately for each individual project and area.

General Approach to Background Concentrations

The default values presented in this memorandum were determined following applicable federal and state requirements and guidance, and the analysis and results proactively subjected to consultation with both VDOT and the Virginia Department of Environmental Quality (DEQ). The results of the analysis as well as the methods and procedures are also addressed in the VDOT *Project-Level Air Quality Analysis Resource Document* as appropriate.

A design value is a statistic that describes the air quality status of a given location relative to the level of the NAAQS. Design values are defined to be consistent with the individual NAAQS and are typically used to designate and classify nonattainment areas, as well as to assess progress towards meeting the NAAQS. For the 1-hour and 8-hour CO NAAQS, design values are based on the 2<sup>nd</sup> maximum mass concentration for the

<sup>1</sup> Background concentrations to be applied in jurisdictions in Virginia that are subject to the federal transportation conformity rule (40 CFR Parts 51 and 93) requirements for project-level air quality analyses are documented in a separate memorandum. At the time of preparation of this document, the only areas subject to conformity requirements for CO in Virginia are Arlington County and the City of Alexandria. The memorandum addressing background concentrations for these areas subject is "*CO and PM<sub>2.5</sub> Background Concentrations for Project-Level Air Quality Modeling (For Jurisdictions Subject to Transportation Conformity Requirements in Northern Virginia)*", from Michael Baker Jr., Inc. (Consultants), to VDOT, dated February 10, 2015.

most recent two years<sup>2</sup>. The design value formulations are used as a basis for determining background concentrations.

As an option to be applied at the discretion of the VDOT, alternative values for background concentrations may be determined on a project-specific basis following the general approach outlined in the *Resource Document*. Alternative values may also be determined following updates to EPA guidance and procedures (in consultation with VDEQ) even if the updated data and procedures have not yet been incorporated into the Department *Resource Document*. Appropriate documentation of the underlying data and calculation would typically be provided with the analysis in those cases.

#### Monitor Locations and Design Values

This section summarizes the methodology for determining design values using the most recent two-years (2012-2013) of monitor data. DEQ is required by EPA to compile and submit summary information for each SLAMS (State and Local Air Monitoring Station) site that is operated in the state's ambient monitoring network. The Virginia Ambient Air Monitoring 2013 Data Report<sup>3</sup> contains the summary data compiled from monitoring stations and is the primary data source for the Virginia station design values provided in this memo. EPA's Air Data website is also a resource for monitor data to determine background concentrations. The data for CO can be downloaded from EPA's Air Data website (<http://www.epa.gov/airdata/>) and tabulated for areas in Virginia and nearby monitors in Washington D.C. and Maryland.

Figures 1 and 2 illustrate the monitor locations that have multiple years of monitor data available. These sites were used for the calculation of the background concentrations. Tables 1a and 1b summarize the monitor values for sites in Virginia, Washington D.C., and neighboring counties in Maryland. For CO, the highest second maximum values during the most recent two year period have been summarized in the tables.

<sup>2</sup> [http://www.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19900618\\_luxton\\_ozone\\_co\\_design\\_value\\_calcs.pdf](http://www.epa.gov/ttn/naaqs/aqmguidance/collection/cp2/19900618_luxton_ozone_co_design_value_calcs.pdf)

<sup>3</sup> The latest monitoring reports are available on DEQ's website:  
<http://www.deq.virginia.gov/Programs/Air/AirMonitoring/Publications.aspx>

Figure 1: Monitor Locations – Regional View

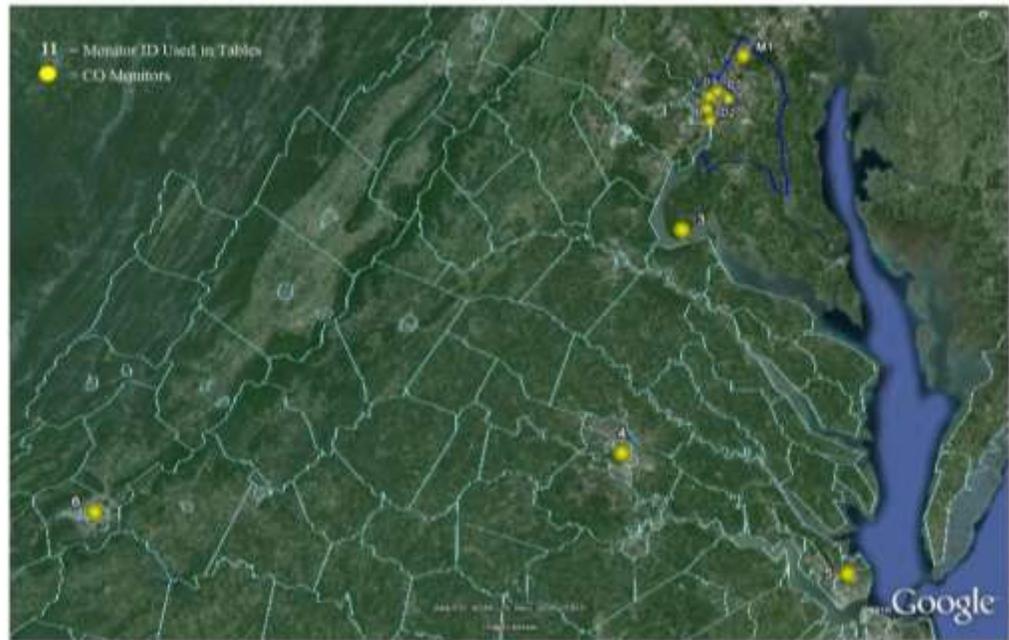


Figure 2: Monitor Locations – Northern Virginia



**Table 1a: CO 2012-2013 Second Maximum Values for Virginia Monitors**

2012-2013 CO Monitoring Data				2012-2013 Highest of Second Max (ppm)	
Site	Region	Site ID	County/City	1-Hour	8-Hour
1	NOVA	515100009*	Alexandria City	1.4	1.0
		515100021*			
2		510130020	Arlington	1.6	1.4
3		510870014	Henrico	1.5	1.2
4	Richmond	517600024**	Richmond City	2.2	1.8
		517600025**			
5	Hampton Roads	516500008	Hampton City	1.1	0.9
		517100024	Norfolk City	2.0	1.1
6	Roanoke	517700015	Roanoke City	1.5	1.2

\* Site ID 515100009 (Alexandria City) was terminated in August 2012 and site ID 515100021 was installed in August 2012 to serve as a special purpose monitor. Per DEQ email on November 22, 2013, this new site might not be representative of a background concentration due to its relative to the impact of the bus operations for DASH and the public schools. Thus, the 2012-2013 second max values from Site ID 515100021 were not used to determine 2011-2013 highest of second max for Alexandria City.

\*\* Site ID 517600024 (Richmond City) was terminated in December 2012 and site ID 517600025 was installed in October 2013.

**Table 1b: CO 2012-2013 Second Maximum Values for DC-MD Monitors**

2012-2013 CO Monitoring Data				2012-2013 Highest of Second Max (ppm)	
Site	State	Site ID	County/City	1-Hour	8-Hour
D1	DC	110010023	District of Columbia	4.4	2.5
D2		110010041	District of Columbia	2.9	2.5
D3		110010043	District of Columbia	2.4	1.8
M1	MD	240330030	Prince George's	1.2	0.9

### Estimation of Default CO Background Concentrations

This section summarizes the default background concentrations for CO to be used for project-level NEPA air quality analyses in Virginia. Per EPA's *Guideline for Modeling Carbon Monoxide from Roadway Intersections* (EPA-454/R-92-005), the ambient monitoring data collected at nearby sites is appropriate for estimating background concentrations.

Statewide estimates of CO background concentrations are needed to support NEPA project-level air quality analyses. The maximum design value in each region over a two year period (shown in **Table 1a**) was selected to represent the background concentration for that region. **Table 2** summarizes the recommended default background concentrations.

**Table 2: Default CO Background Concentrations for Virginia Statewide**

Region		Background Concentration (ppm)	
		2012-2013 Highest of Second Max	
		1-Hour	8-Hour
Urban Areas	NOVA	1.6	1.4
	Richmond	2.2	1.8
	Hampton Roads	2.0	1.1
	Roanoke	1.5	1.2
	Others*	1.8	1.4
Rural Areas	All	1.5	1.1

\* The default CO background concentration for other urban areas is calculated by averaging the default values of all urban areas listed above.

Based on the 30-year average wind rose data obtained from the Automated Surface Observing System (ASOS), the annual average wind directions in Northern Virginia are primarily blowing from the south and northwest directions. Therefore, the D.C. and Maryland monitors, which are located north or northeast of Northern Virginia, are not considered to be representative of background concentrations in Northern Virginia.

The monitor data in Arlington County was used for the Northern Virginia region since it has the highest value in the region. There are no CO monitors in Fairfax, Loudoun and Prince William Counties. For rural areas, the lowest of urban area monitors (located in Henrico County) was selected as there are no rural CO monitor locations in Virginia. The Henrico monitor values are consistent with the monitor values in Prince George County, Maryland.

# Project-Level Air Quality Resource Document

## APPENDIX I: METEOROLOGICAL DATA SOURCES

I1: SCRAM Meteorological Data Files for CAL3QHCR

I2: DEQ AERMOD Meteorological Data Files

I3: DEQ AERMOD Meteorological Data Processing Instructions

## APPENDIX I1: SCRAM METEOROLOGICAL DATA FILES FOR CAL3QHCR

The most recent 5-year (1986-1991) SCRAM surface and upper air meteorological data files were obtained from EPA's website (<http://www.epa.gov/ttn/scram/surfacemetdata.htm>). These meteorological data files need to be further processed using the meteorological processor PCRAMMET ([http://www.epa.gov/ttn/scram/metobsdata\\_procaccprogs.htm](http://www.epa.gov/ttn/scram/metobsdata_procaccprogs.htm)) to combine the SCRAM surface and upper air meteorological data into a single file for application with the CAL3QHCR model. If a CAL3QHCR analysis is completed, the meteorological data used for the analysis would be provided on the VDOT website.

The surface meteorological data for the closest airports to the 5-county NOVA region, including the DCA airport (station ID 13743) and the IAD airport (station ID 93738), are used for the dispersion modeling. The upper air mixing height meteorological data for the station ID 93734, located in Sterling VA, is used for the dispersion modeling. Below provides a summary of the available SCRAM meteorological data files for the NOVA region.

CAL3QHCR				
Sub-Folder	File Name(s)	Extension	Modeling Use	Default Jurisdiction Assignment
DCA	S13743 <b>87</b> and 93734- <b>87</b> (88/89/90/91)	.DAT and .TXT	SCRAM meteorological surface and upper air data files. Need to be processed using PCRAMMET to develop final format for CAL3QHCR meteorological data (current most recent available years are 1986-1991).	<ul style="list-style-type: none"> <li>▪ Arlington County</li> <li>▪ City of Alexandria</li> <li>▪ Fairfax County: For project areas closer to the DCA airport</li> </ul>
IAD	S93738 <b>86</b> and 93734- <b>86</b> (87/88/90/91)	.DAT and .TXT		<ul style="list-style-type: none"> <li>▪ Fairfax County: for project areas closer to the IAD airport</li> <li>▪ Loudoun County</li> <li>▪ Prince William County</li> </ul>

## APPENDIX I2: DEQ AERMOD METEOROLOGICAL DATA FILES

AERMOD				
Sub-Folder	File Name(s)	Extension	Modeling Use	Default Jurisdiction Assignment
DCA_STR_2009_2013	DCA_2009 (10/11/12/13)	.SFC and .PFL	Final format for AERMOD surface (.SFC) and profile (“upper air”) (.PFL) meteorological data (current available years are 2009-2013).	<ul style="list-style-type: none"> <li>▪ Arlington County</li> <li>▪ City of Alexandria</li> <li>▪ Fairfax County (project areas closer to DCA)</li> </ul>
IAD_STR_2009_2013	IAD_2009 (10/11/12/13)	.SFC and .PFL		<ul style="list-style-type: none"> <li>▪ Fairfax County (project areas closer to IAD)</li> <li>▪ Loudoun County</li> <li>▪ Prince William County</li> </ul>

## APPENDIX I3: DEQ AERMOD METEOROLOGICAL PROCESSING INSTRUCTIONS

### Meteorological Data Processing

Five years (2009-2013) of hourly surface meteorological data from Dulles International Airport, VA (IAD) and Reagan National Airport, VA (DCA), along with concurrent upper air data from Sterling, VA were processed with AERMET, the meteorological preprocessor for AERMOD. Table 1 gives site locations and information on these data sets.

**Table 1: Meteorological Data Used in Running AERMET**

Meteorological Site	Latitude	Longitude	Base Elevation (m)	Data Source	Data Format
Dulles Airport, VA	38.934	-77.447	88	NCDC	ISHD and 1-min ASOS
Reagan Airport, VA	38.847	-77.035	4	NCDC	ISHD and 1-min ASOS
Sterling, VA	38.983	-77.467	85	FSL	FSL

The surface data (wind direction, wind speed, temperature, sky cover, and relative humidity) at both stations are measured 10 meters above ground level.

The latest version of AERMET (14134) and AERMINUTE (14237), the meteorological preprocessors, were used to create AERMOD-Ready meteorological inputs.

AERMET creates two output files for input to AERMOD:

- **SURFACE:** a file with boundary layer parameters such as sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer, and convective and mechanical mixing heights. Also provided are values of Monin-Obukhov length, surface roughness, albedo, Bowen ratio, wind speed, wind direction, temperature, and heights at which measurements were taken.
- **PROFILE:** a file containing multi-level meteorological data with wind speed, wind direction, temperature, sigma-theta ( $\sigma_\theta$ ) and sigma-w ( $\sigma_w$ ) when such data are available. For this project, which utilizes representative data from the nearest NWS station, the profile file contains a single level of wind data (10 meters) and temperature data (2 meters). In running AERMET, the observed airport hourly wind directions were randomized. Missing morning soundings in the Sterling, VA upper air files were filled with soundings from Aberdeen (Phillips Field), Maryland when available, or the previous day's sounding from Sterling if the Aberdeen sounding was also missing.

AERMET requires specification of site characteristics including surface roughness ( $z_o$ ), albedo ( $r$ ), and Bowen ratio ( $B_o$ ). These parameters were developed according to the guidance provided by US EPA in the AERMOD Implementation Guide (AIG) (EPA, 2009) and input provided by the Virginia Department of Environmental Quality (VADEQ).

The revised AIG provides the following recommendations for determining the site characteristics:

1. The determination of the surface roughness length should be based on an inverse distance weighted geometric mean for a default upwind distance of 1 kilometer relative to the measurement site. Surface roughness length may be varied by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees.
2. The determination of the Bowen ratio should be based on a simple un-weighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10-km by 10-km region centered on the measurement site.
3. The determination of the albedo should be based on a simple un-weighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10-km by 10-km region centered on the measurement site.

The AIG recommends that the surface characteristics be determined based on digitized land cover data. US EPA has developed a tool called AERSURFACE (EPA, 2008) that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above. AERSURFACE incorporates look-up tables of representative surface characteristic values by land cover category and seasonal category. AERSURFACE was applied with the instructions provided in the AERSURFACE User's Guide and input provided by VADEQ.

The current version of AERSURFACE (Version 13016) supports the use of land cover data from the USGS National Land Cover Data 1992 archives<sup>1</sup> (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The AIG recommends that the surface characteristics be determined based on the land use surrounding the site where the surface meteorological data were collected. The selection of the land use types assigned in the NLCD92 database was reviewed

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<sup>1</sup> <http://landcover.usgs.gov/natl/landcover.php>

for both the IAD and DCA airports. The IAD land use types were altered using the justification contained in **Appendix I3-a**.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the meteorological station site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. Sectors used to define the meteorological surface characteristics for each airport site are shown in **Figure 1 through Figure 4**.

In AERSURFACE, the various land cover categories are linked to a set of seasonal surface characteristics. As such, AERSURFACE requires specification of the seasonal category for each month of the year. The following five seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this site as provided by VADEQ.

1. Midsummer with lush vegetation (May-September);
2. Autumn with un-harvested cropland (October-November);
3. Late autumn after frost and harvest, or winter with no snow (December-February);
4. Winter with continuous snow on ground (none); and
5. Transitional spring with partial green coverage or short annuals (March-April).

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet, and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics were applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in AERSURFACE User's Guide, the surface moisture condition for each month was determined by comparing precipitation for the period of data to be processed to the 30-year climatological record, selecting "wet" conditions if precipitation is in the upper 30th-percentile, "dry" conditions if precipitation is in the lower 30th-percentile, and "average" conditions if precipitation is in the middle 40th-percentile. The 30-year precipitation data set used in this modeling was taken from the applicable airport. The 30-year period of record used to establish the 30-year average monthly precipitation totals include 1984 through 2013. The monthly designations of surface moisture input to AERSURFACE are summarized in **Table 2**.

**Table 3** summarizes the meteorological data files used as input to AERMET processing and the output files produced by AERMET.

Table 2: AERSURFACE Bowen Ratio Condition Designations

<b>Dulles International Airport</b>					
<b>Month</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
January	Average	Dry	Dry	Dry	Wet
February	Dry	Wet	Average	Average	Dry
March	Dry	Average	Wet	Dry	Average
April	Average	Dry	Wet	Dry	Dry
May	Wet	Wet	Average	Wet	Average
June	Wet	Dry	Dry	Dry	Average
July	Dry	Average	Average	Dry	Wet
August	Average	Average	Average	Average	Dry
September	Dry	Wet	Wet	Average	Dry
October	Wet	Average	Wet	Wet	Wet
November	Average	Average	Dry	Dry	Average
December	Wet	Dry	Wet	Average	Wet
<b>Reagan National Airport</b>					
<b>Month</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
January	Average	Dry	Dry	Dry	Average
February	Dry	Wet	Average	Average	Dry
March	Dry	Average	Wet	Dry	Average
April	Wet	Dry	Average	Dry	Average
May	Wet	Dry	Dry	Average	Average
June	Wet	Dry	Dry	Average	Wet
July	Dry	Wet	Average	Dry	Average
August	Average	Average	Wet	Average	Dry
September	Average	Wet	Wet	Average	Dry
October	Wet	Average	Average	Wet	Wet
November	Average	Average	Average	Dry	Average
December	Wet	Dry	Wet	Average	Wet

**Table 3: DEQ AERMET Meteorological Data Files**

Sub-Folder	File Name(s)	Extension	Use
<b>AERMET- Last Step in Processing Raw Meteorology Data</b>			
DCA_STR_2009_2013	DCA_2009 (10/11/12/13)	.PFL and .SFC	Final format for AERMOD meteorology data.
	13743_DCA_2009 (10/11/12/13)	.IN1	Input file for Stage 1 AERMET Processing
	13743_DCA_2009 (10/11/12/13)	.MS1	Messages from Stage 1 Processing
	13743_DCA_2009 (10/11/12/13)	.RP1	Stage 1 processing report (tells whether successful or not)
	13743_DCA_2009 (10/11/12/13)	.IN2	Input File for Stage 2 AERMET Processing
	13743_DCA_2009 (10/11/12/13)	.MRG	Output from Stage 2 AERMET Processing
	13743_DCA_2009 (10/11/12/13)	.MS2	Messages from Stage 2 Processing
	13743_DCA_2009 (10/11/12/13)	.RP2	Stage 2 processing report (tells whether successful or not)
	13743_DCA_2009 (10/11/12/13)	.IN3	Input File for Stage 3 AERMET Processing
	13743_DCA_2009 (10/11/12/13)	.MS3	Messages from Stage 3 Processing
13743_DCA_2009 (10/11/12/13)	.RP3	Stage 3 processing report (tells whether successful or not)	
<b>AERMINUTE – Processes 1 minute ASOS wind data</b>			
	DCA_hourly_winds_2009 (10/11/12/13)	(no file extension)	Hourly average winds file used as input for AERMET stage 2 processing
	DCA_Summary_2009 (10/11/12/13)	(no file extension)	Summary output file that lists each hour in the data period.
	DCA_Data_Comparison_2009 (10/11/12/13)	(no file extension)	Output file that compares the standard observations against the 1-minute observations.
	DCA_aerminute_2009 (10/11/12/13)	.LOG	Summary of processing and input/output.
	DCA_bad_records_2009 (10/11/12/13)	.DAT	Listing of records that did not meet the quality control checks and are unlikely to contain usable data
	DCA_good_records_2009 (10/11/12/13)	.DAT	Listing of all records meeting quality control checks and used in calculating hourly averages
	DCA_check_records_2009 (10/11/12/13)	.DAT	Listing of records not meeting quality control checks and not used in calculating hourly averages
<b>AERSURFACE – Used to obtain surface characteristics values for AERMET</b>			
DCA/Avg_AerSurface	AERSURFACE	.DAT	Summary of responses to program prompts
	DCA_Aersurface_avg	.LOG	Extraction of land cover data and a tally of number of land cover grid cells.
	Albedo_bowen_domain	.TXT	Output with extracted land cover data for albedo bowen ratio
	Roughness_domain	.TXT	Output with extracted land cover data for surface roughness domains
<b>DCA_Sfc_13743</b>			
	724050-13743-2009 (10/11/12/13)	No file extension	Raw surface data for AERMET
1_min_2009 (10/11/12/13)	64050KDA200901 (02-12)	.DAT	Monthly 1 minute ASOS wind data
<b>Landuse</b>			
	87921381	.ZIP	Zip file containing Land use .tif files for AERSURFACE
<b>Precipitation</b>			
	DCA_1984_2013_precipitation	.XLS	Precipitation summary for years 1984 to 2013
<b>STR_UA_93734 (used as AERMET input)</b>			
	93734_5yr_2009_2013_filled	.FSL	Archive of Upper Air data

This file structure is for DCA. The same file structure and naming is used for IAD and is not repeated here. In addition for AERSURFACE, the same file type of structures are used for DRY\_AERSURFACE and WET\_AERSURFACE and are not repeated.

Figure 1: Sectors Used for Surface Characteristics at Dulles International Airport



**Figure 2: 1-Km Radius for Dulles International Airport with Surface Roughness Sectors Shown on Land Use Imagery**

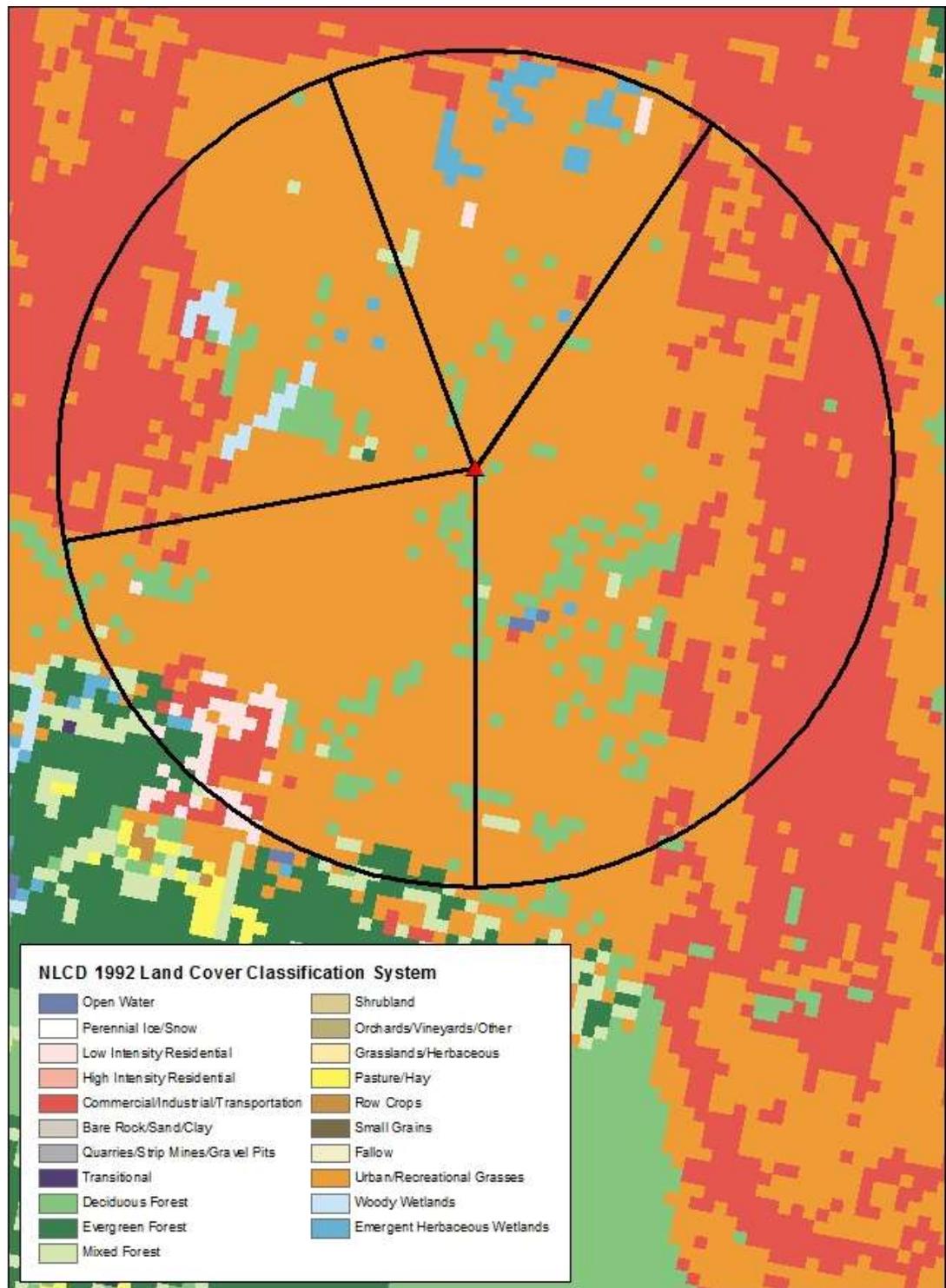
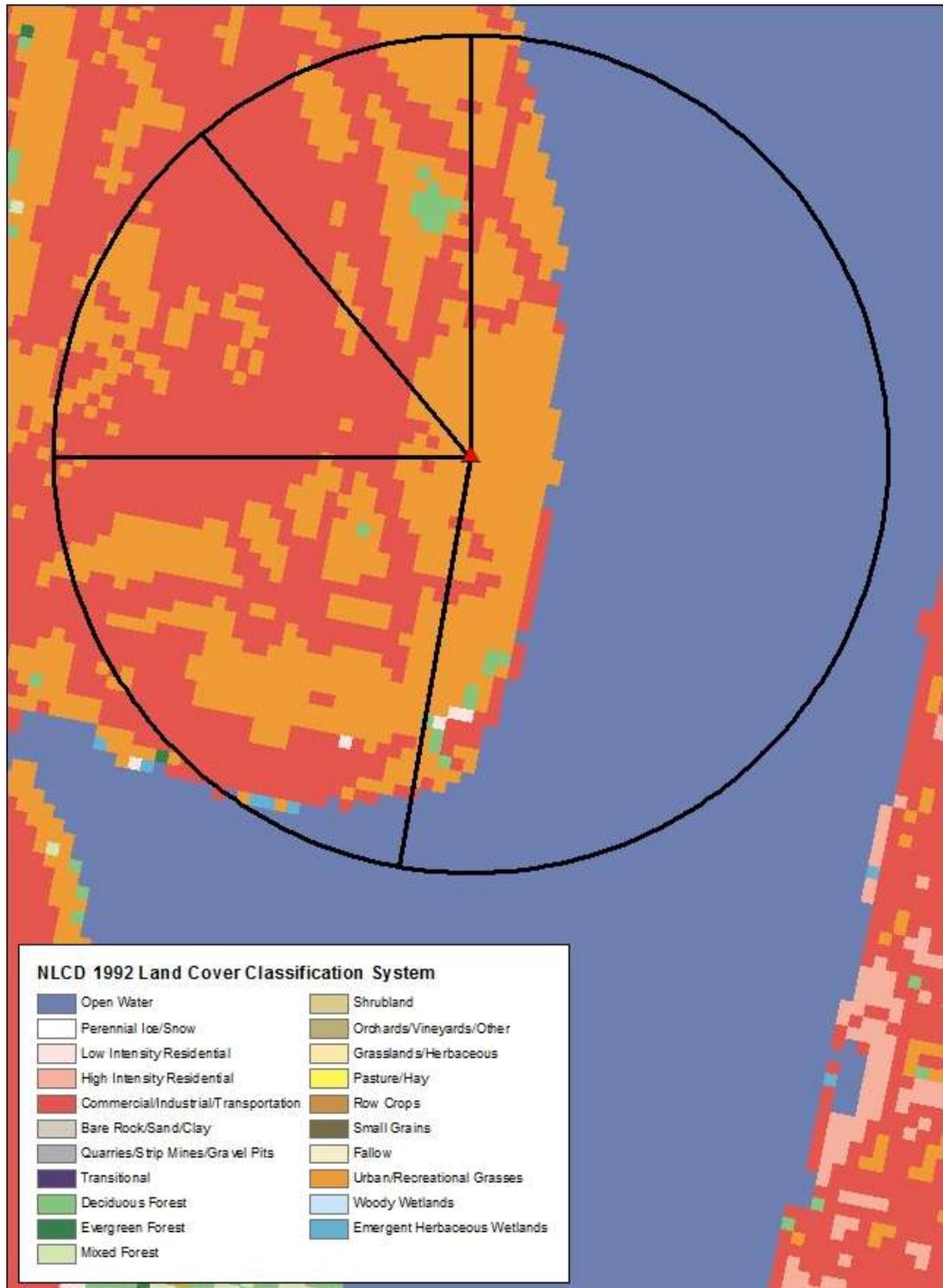


Figure 3: Sectors Used for Surface Characteristics at Reagan National Airport



Figure 4: 1-Km Radius for Reagan National Airport with Surface Roughness Sectors Shown on Land Use Imagery



## APPENDIX I3-a to Meteorological Data Processing Site-Specific AERSURFACE Methodology for Dulles International Airport

AERMET, the meteorological data preprocessor for the AERMOD modeling system, was used for the processing of the Dulles International Airport (IAD) meteorological data. One of the steps needed for the meteorological data processing is the determination of appropriate surface characteristics needed by AERMET (surface roughness, Bowen ratio, and albedo) from digital land use data provided as input to the AERSURFACE program.

The current version of AERSURFACE (Version 13016) supports the use of land cover data from the USGS National Land Cover Data 1992 archives (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The AERMOD Implementation Guide (AIG) recommends that the surface characteristics are determined based on the land use within 1 kilometer from the site where the surface meteorological data were collected. The selection of the land use types assigned in the NLCD92 database were reviewed and altered with justification based upon a site-specific analysis as discussed below.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the meteorological station site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. The land use depiction is shown in Figure 1 as an aerial photo and in Figure 2 with the digital land use assignments. It is evident from Figure 2 that the 1-km circle is dominated by the land use category 85 (“urban/recreational grasses”). A description of this type of land cover is contained in the AERSURFACE User’s Guide (EPA-454/B-08-001, January 2008, Revised 01/16/2013) and is as follows:

“Vegetation (primarily grasses) planted in developed settings for recreation, erosion control, or aesthetic purposes. Examples include parks, lawns, golf courses, airport grasses, and industrial site grasses.” The very low surface roughness lengths associated with this land use category indicate that these areas are kept well manicured and mowed, such as a lawn<sup>2</sup> with a height of 2 cm. A review of Figure 1 indicated that the area in question was not consistent with this characterization.

Further investigation involved a review of photos of the Dulles airport anemometer site in 8 cardinal directions, provided in Figures 3 through 10 for directions looking north clockwise through northwest. It is evident from the photos that the nature of the grassland (with occasional shrubs) is such that the area is not consistent with mowed and manicured lawns, but rather natural grasslands such as those used for grazing. The Randerson reference indicates that for grassy areas with a height of about 50 cm (similar to that in the photographs), the roughness length should be about 10 cm. This value matches that for a more appropriate land use category, which is 71 (grasslands/herbaceous). This change was therefore made to the AERSURFACE run by introducing an IF statement in the FORTRAN code that changed the land use category from 85 to 71 for this meteorological station.

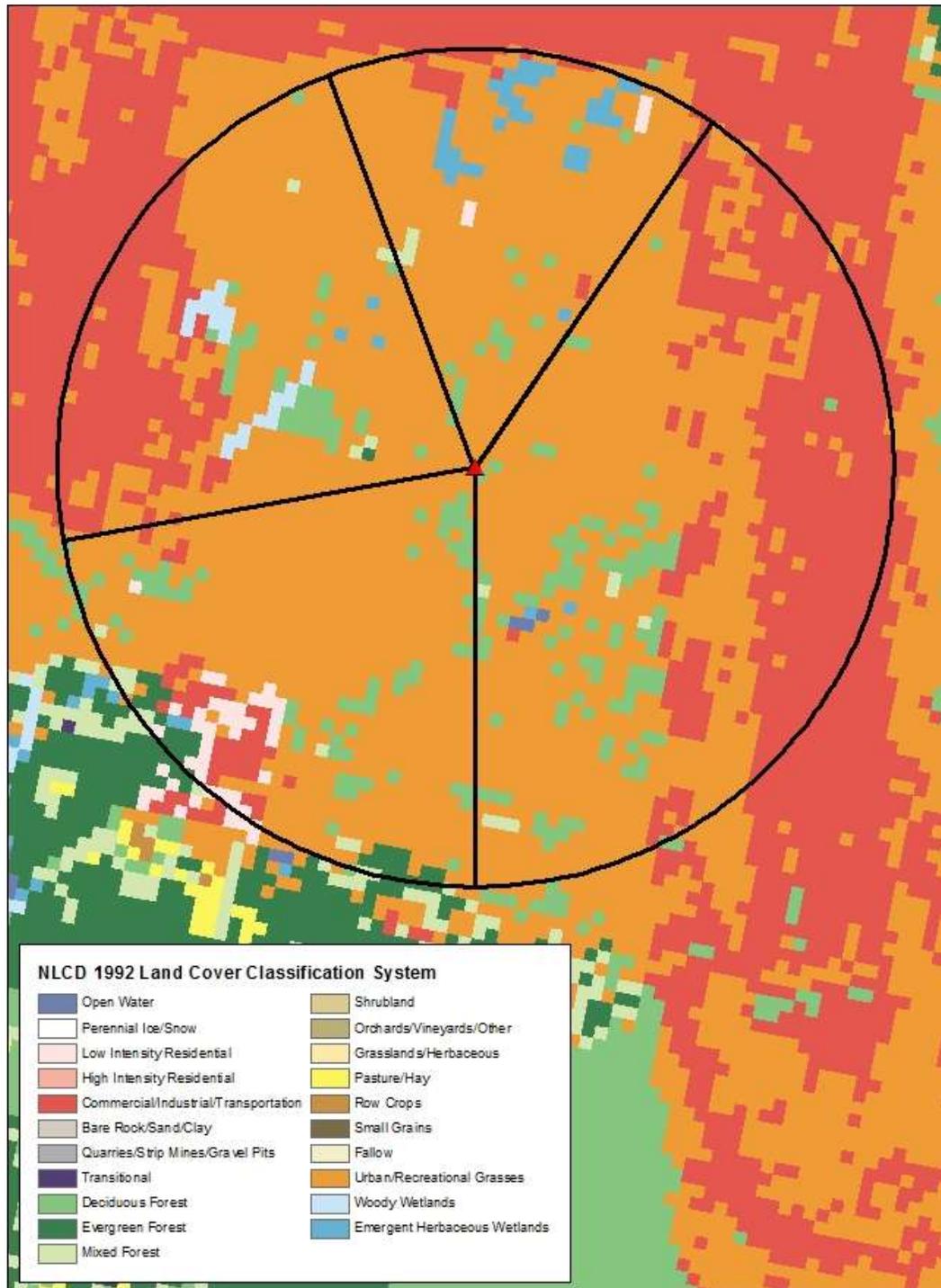
---

<sup>2</sup> The AERSURFACE citation for the grassy area surface roughness values is Table 5.4 in Randerson, D., 1984, “Atmospheric Boundary Layer,” in *Atmospheric Science and Power Production*, ed., D. Randerson. Technical Information Center, Office of Science and Technical Information, U.S. Department of Energy, Springfield, VA, 850pp. This table indicates that the surface roughness is about 1/10 of the height of the grass.

Appendix I3-a Figure 1: Sectors Used for Surface Characteristics at Dulles International Airport



Appendix I3-a Figure 2: 1-Km Radius for Dulles International Airport with Surface Roughness Sectors Shown on Land Use Imagery



Appendix I3-a Figure 3: View of Dulles Meteorological Station Looking North



Appendix I3-a Figure 4: View of Dulles Meteorological Station Looking Northeast



Appendix I3-a Figure 5: View of Dulles Meteorological Station Looking East



Appendix I3-a Figure 6: View of Dulles Meteorological Station Looking Southeast



Appendix I3-a Figure 7: View of Dulles Meteorological Station Looking South



Appendix I3-a Figure 8: View of Dulles Meteorological Station Looking Southwest



Appendix I3-a Figure 9: View of Dulles Meteorological Station Looking West



Appendix I3-a Figure 10: View of Dulles Meteorological Station Looking Northwest



# Project-Level Air Quality Resource Document

## APPENDIX J: SAMPLE PROJECT LEVEL INPUT FILES

J1: MOVES Input Data

J2: CAL3QHC Input Data

J3: CAL3QHCR Input Data

J4: AERMOD Input Data

## APPENDIX J1: MOVES INPUT DATA

### MOVES MRS Input Files

- Separate MRS files are provided for CO, MSATS and PM<sub>2.5</sub> in the online data repository
- For the PM<sub>2.5</sub> Annual NAAQS, separate MRS files are typically provided for each time period (4) x season (4) = 16 files
- For MOVES2014, E-85 fuel needs to be included for passenger car, passenger truck and light commercial truck (source types 21, 31 and 32)
- Sample files for CO, PM<sub>2.5</sub> and MSATS analyses are provided below:

### [Sample MRS file for winter (January) weekday for CO]

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<runspec version="MOVES2014-20141021">
  <description><![CDATA[description text]]></description>
  <models>
    <model value="ONROAD"/>
  </models>
  <modelscale value="Inv"/> → [use "Inventory" approach (Inv) for CAL3QHC and AERMOD modeling and "Emission Rates" approach (Rates) for CAL3QHCR modeling]
  <modeldomain value="PROJECT"/> → [project scale analysis]
  <geographicselections>
    <geographicselection type="COUNTY" key="CountyFIPSCode" description="County Selection"/>
  </geographicselections>
  <timespan>
    <year key="Year"/> → [analysis year]
    <month id="1"/> → [analysis month]
    <day id="5"/> → [type of day, enter 5 for weekday and 2 for weekend]
    <beginhour id="18"/> → [specify the hour representing the desired time period for modeling]
    <endhour id="18"/>
    <aggregateBy key="Hour"/>
  </timespan>
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Truck"/>
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</roadtypes>
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Exhaust"/>
<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="15"
processname="Crankcase Running Exhaust"/>
</pollutantprocessassociations>
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</databaseselections>
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"><![CDATA[
useParameters No
]]></internalcontrolstrategy>
</internalcontrolstrategies>
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<uncertaintyparameters uncertaintymodeenabled="false" numberofrunsperimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="LINK"/>
<outputemissionsbreakdownselection>
<modelyear selected="false"/>
<fueltype selected="false"/>
<emissionprocess selected="true"/>
<onroadoffroad selected="true"/>
<roadtype selected="true"/>
<sourceusetype selected="false"/>
<movesvehicletype selected="false"/>
<onroadscc selected="false"/>

```

```

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    <sector selected="false"/>
    <engtechid selected="false"/>
    <hpclass selected="false"/>
    <regclassid selected="false"/>
</outputemissionsbreakdownselection>
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<outputsho value="false"/>
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<outputshidling value="false"/>
<outputstarts value="false"/>
<outputpopulation value="true"/>
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<pmsize value="0"/>
<outputfactors>
    <timefactors selected="true" units="Hours"/>
    <distancefactors selected="true" units="Miles"/>
    <massfactors selected="true" units="Grams" energyunits="Million BTU"/>
</outputfactors>
<savedata>

</savedata>

<donotexecute>

</donotexecute>

<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
    <donotperformfinalaggregation selected="false"/>
<lookupableflags scenarioid="" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>

```

### [Sample MRS file for January AM period for PM<sub>2.5</sub>]

```

<runspec version="MOVES2014-20141021">
  <description><![CDATA[description text]]></description>
  <models>
    <model value="ONROAD"/>
  </models>
  <modelscale value="Inv"/> → [use "Inventory" approach (Inv) for CAL3QHC and AERMOD modeling and "Emission Rates" approach (Rates) for CAL3QHCR modeling]
  <modeldomain value="PROJECT"/> → [project scale analysis]
  <geographicselections>
    <geographicselection type="COUNTY" key="CountyFIPSCode" description="County Selection"/>
  </geographicselections>
  <timespan>
    <year key="Year"/> → [analysis year]
    <month id="1"/> → [analysis month]
    <day id="5"/> → [type of day, enter 5 for weekday and 2 for weekend]
    <beginhour id="7"/> → [specify the hour representing the desired time period for modeling]
    <endhour id="7"/>
    <aggregateBy key="Hour"/>

```

```

</timespan>
<onroadvehicleselections>
  <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42"
sourcetyname="Transit Bus"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetyname="Combination Long-haul
Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetyname="Combination Short-haul
Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetyname="Intercity Bus"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetyname="Light Commercial
Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetyname="Motor Home"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="11" sourcetyname="Motorcycle"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetyname="Passenger Car"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetyname="Passenger Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetyname="Refuse Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="43" sourcetyname="School Bus"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetyname="Single Unit Long-haul
Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetyname="Single Unit Short-haul
Truck"/>
  <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetyname="Transit Bus"/>
  <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="32" sourcetyname="Light Commercial
Truck"/>
  <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="21" sourcetyname="Passenger Car"/>
  <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="31" sourcetyname="Passenger Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="62" sourcetyname="Combination Long-haul
Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetyname="Combination Short-haul
Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="41" sourcetyname="Intercity Bus"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetyname="Light Commercial Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="54" sourcetyname="Motor Home"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="11" sourcetyname="Motorcycle"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetyname="Passenger Car"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetyname="Passenger Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetyname="Refuse Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetyname="School Bus"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetyname="Single Unit Long-haul
Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetyname="Single Unit Short-haul
Truck"/>
  <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetyname="Transit Bus"/>
</onroadvehicleselections>
<offroadvehicleselections>
</offroadvehicleselections>
<offroadvehiclesccs>
</offroadvehiclesccs>
<roadtypes separateramps="false">
  <roadtype roadtypeid="1" roadtypename="Off-Network" modelCombination="M1"/>
  <roadtype roadtypeid="2" roadtypename="Rural Restricted Access" modelCombination="M1"/>
  <roadtype roadtypeid="3" roadtypename="Rural Unrestricted Access" modelCombination="M1"/>
  <roadtype roadtypeid="4" roadtypename="Urban Restricted Access" modelCombination="M1"/>
  <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access" modelCombination="M1"/>
</roadtypes>
<pollutantprocessassociations>
[Below are pollutants included for PM2.5 Analysis]
  <pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="2" processname="Start
Exhaust"/>

```

```

    <pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="90"
processname="Extended Idle Exhaust"/>
    <pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="91"
processname="Auxiliary Power Exhaust"/>
    <pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="2" processname="Start
Exhaust"/>
    <pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="90" processname="Extended
Idle Exhaust"/>
    <pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="91" processname="Auxiliary
Power Exhaust"/>
    <pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="2" processname="Start Exhaust"/>
    <pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="90" processname="Extended Idle
Exhaust"/>
    <pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="91" processname="Auxiliary Power
Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="2"
processname="Start Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="16"
processname="Crankcase Start Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="17"
processname="Crankcase Extended Idle Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="90"
processname="Extended Idle Exhaust"/>
    <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="91"
processname="Auxiliary Power Exhaust"/>
    <pollutantprocessassociation pollutantkey="116" pollutantname="Primary PM2.5 - Brakewear Particulate" processkey="9"
processname="Brakewear"/>
    <pollutantprocessassociation pollutantkey="117" pollutantname="Primary PM2.5 - Tirewear Particulate" processkey="10"
processname="Tirewear"/>
    <pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="2" processname="Start
Exhaust"/>
    <pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="90" processname="Extended
Idle Exhaust"/>
    <pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="91" processname="Auxiliary
Power Exhaust"/>
</pollutantprocessassociations>
<databaseselections>
</databaseselections>
<internalcontrolstrategies>
<internalcontrolstrategy
classname="gov.epa.otaq.moves.master.implementation.ghg.internalcontrolstrategies.rateofprogress.RateOfProgressStrategy
"><![CDATA[
useParameters      No

]]></internalcontrolstrategy>
</internalcontrolstrategies>
<inputdatabase servername="" databasename="" description=""/>
<uncertaintyparameters uncertaintymodeenabled="false" numberofruns persimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="LINK"/>
<outputemissionsbreakdownselection>
    <modelyear selected="false"/>

```

```
<fueltype selected="false"/>
<emissionprocess selected="true"/>
<onroadoffroad selected="true"/>
<roadtype selected="true"/>
<sourceusetype selected="false"/>
<movesvehicletype selected="false"/>
<onroadscc selected="false"/>
<estimateuncertainty selected="false" numberOfIterations="2" keepSampledData="false" keepIterations="false"/>
<sector selected="false"/>
<engtechid selected="false"/>
<hpclass selected="false"/>
<regclassid selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="localhost" databasename="Output database name" description=""/>
<outputtimestep value="Hour"/>
<outputvmtdata value="true"/>
<outputsho value="false"/>
<outputsh value="false"/>
<outputshp value="false"/>
<outputshidling value="false"/>
<outputstarts value="false"/>
<outputpopulation value="true"/>
<scaleinputdatabase servername="localhost" databasename="Input database name" description=""/>
<pmsize value="0"/>
<outputfactors>
  <timefactors selected="true" units="Hours"/>
  <distancefactors selected="true" units="Miles"/>
  <massfactors selected="true" units="Grams" energyunits="Million BTU"/>
</outputfactors>
<savedata>

</savedata>

<donotexecute>

</donotexecute>

<generatordatabase shouldsave="false" servername="" databasename="" description=""/>
  <donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="false" truncateactivity="false" truncatebaserates="true"/>
</runspec>
```

**[Sample MRS file for MSAT]**

```

<runspec version="MOVES2014-20141021">
  <description><![CDATA[description text]]></description>
  <models>
    <model value="ONROAD"/>
  </models>
  <modelscale value="Inv"/> → [use "Inventory" approach]
  <modeldomain value="SINGLE"/> → [county scale analysis]
  <geographicselections>
    <geographicselection type="COUNTY" key="CountyFIPSCode" description="County Selection"/>
  </geographicselections>
  <timespan>
    <year key="Year"/> → [analysis year]
    <month id="1"/>
    <month id="4"/>
    <month id="7"/>
    <month id="10"/>
    <day id="5"/> → [type of day, enter 5 for weekday and 2 for weekend]
    <beginhour id="1"/>
    <endhour id="24"/>
    <aggregateBy key="Hour"/>
  </timespan>
  <onroadvehicleselections>
    <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42"
sourcetyname="Transit Bus"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetyname="Combination Long-haul
Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetyname="Combination Short-haul
Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetyname="Intercity Bus"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetyname="Light Commercial
Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetyname="Motor Home"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetyname="Passenger Car"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetyname="Passenger Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetyname="Refuse Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="43" sourcetyname="School Bus"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetyname="Single Unit Long-haul
Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetyname="Single Unit Short-haul
Truck"/>
    <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetyname="Transit Bus"/>
    <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="32" sourcetyname="Light Commercial
Truck"/>
    <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="21" sourcetyname="Passenger Car"/>
    <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="31" sourcetyname="Passenger Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetyname="Combination Short-haul
Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetyname="Light Commercial Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="54" sourcetyname="Motor Home"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="11" sourcetyname="Motorcycle"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetyname="Passenger Car"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetyname="Passenger Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetyname="Refuse Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetyname="School Bus"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetyname="Single Unit Long-haul
Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetyname="Single Unit Short-haul
Truck"/>
    <onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetyname="Transit Bus"/>

```

```

</onroadvehicleselections>
</offroadvehicleselections>
</offroadvehicleselections>
<offroadvehiclesccs>
</offroadvehiclesccs>
<roadtypes separateramps="false">
  <roadtype roadtypeid="4" roadtypename="Urban Restricted Access" modelCombination="M1"/>
  <roadtype roadtypeid="5" roadtypename="Urban Unrestricted Access" modelCombination="M1"/>
</roadtypes>
<pollutantprocessassociations>
[Below are pollutants included for PM2.5 Analysis]
  <pollutantprocessassociation pollutantkey="24" pollutantname="1,3-Butadiene" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="24" pollutantname="1,3-Butadiene" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="170" pollutantname="Acenaphthene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="170" pollutantname="Acenaphthene gas" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="70" pollutantname="Acenaphthene particle" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="70" pollutantname="Acenaphthene particle" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="171" pollutantname="Acenaphthylene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="171" pollutantname="Acenaphthylene gas" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="71" pollutantname="Acenaphthylene particle" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="71" pollutantname="Acenaphthylene particle" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="27" pollutantname="Acrolein" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="27" pollutantname="Acrolein" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="172" pollutantname="Anthracene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="172" pollutantname="Anthracene gas" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="72" pollutantname="Anthracene particle" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="72" pollutantname="Anthracene particle" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="173" pollutantname="Benz(a)anthracene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="173" pollutantname="Benz(a)anthracene gas" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="73" pollutantname="Benz(a)anthracene particle" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="73" pollutantname="Benz(a)anthracene particle" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="20" pollutantname="Benzene" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="20" pollutantname="Benzene" processkey="11" processname="Evap Permeation"/>
  <pollutantprocessassociation pollutantkey="20" pollutantname="Benzene" processkey="13" processname="Evap Fuel Leaks"/>
  <pollutantprocessassociation pollutantkey="20" pollutantname="Benzene" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="174" pollutantname="Benzo(a)pyrene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="174" pollutantname="Benzo(a)pyrene gas" processkey="15" processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="74" pollutantname="Benzo(a)pyrene particle" processkey="1" processname="Running Exhaust"/>

```

```

    <pollutantprocessassociation pollutantkey="74" pollutantname="Benzo(a)pyrene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="175" pollutantname="Benzo(b)fluoranthene gas" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="175" pollutantname="Benzo(b)fluoranthene gas" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="75" pollutantname="Benzo(b)fluoranthene particle" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="75" pollutantname="Benzo(b)fluoranthene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="176" pollutantname="Benzo(g,h,i)perylene gas" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="176" pollutantname="Benzo(g,h,i)perylene gas" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="76" pollutantname="Benzo(g,h,i)perylene particle" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="76" pollutantname="Benzo(g,h,i)perylene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="177" pollutantname="Benzo(k)fluoranthene gas" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="177" pollutantname="Benzo(k)fluoranthene gas" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="77" pollutantname="Benzo(k)fluoranthene particle" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="77" pollutantname="Benzo(k)fluoranthene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="178" pollutantname="Chrysene gas" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="178" pollutantname="Chrysene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="78" pollutantname="Chrysene particle" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="78" pollutantname="Chrysene particle" processkey="15" processname="Crankcase
Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="118" pollutantname="Composite - NonECPM" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="168" pollutantname="Dibenzo(a,h)anthracene gas" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="168" pollutantname="Dibenzo(a,h)anthracene gas" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="68" pollutantname="Dibenzo(a,h)anthracene particle" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="68" pollutantname="Dibenzo(a,h)anthracene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="112" pollutantname="Elemental Carbon" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="169" pollutantname="Fluoranthene gas" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="169" pollutantname="Fluoranthene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="69" pollutantname="Fluoranthene particle" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="69" pollutantname="Fluoranthene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="181" pollutantname="Fluorene gas" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="181" pollutantname="Fluorene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="81" pollutantname="Fluorene particle" processkey="1" processname="Running
Exhaust"/>
    <pollutantprocessassociation pollutantkey="81" pollutantname="Fluorene particle" processkey="15" processname="Crankcase
Running Exhaust"/>

```

```

Exhaust"/>
  <pollutantprocessassociation pollutantkey="25" pollutantname="Formaldehyde" processkey="1" processname="Running
Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="25" pollutantname="Formaldehyde" processkey="15" processname="Crankcase
Exhaust"/>
  <pollutantprocessassociation pollutantkey="119" pollutantname="H2O (aerosol)" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="182" pollutantname="Indeno(1,2,3,c,d)pyrene gas" processkey="1"
processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="182" pollutantname="Indeno(1,2,3,c,d)pyrene gas" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="82" pollutantname="Indeno(1,2,3,c,d)pyrene particle" processkey="1"
processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="82" pollutantname="Indeno(1,2,3,c,d)pyrene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="11" processname="Evap
Permeation"/>
  <pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="13" processname="Evap Fuel
Leaks"/>
  <pollutantprocessassociation pollutantkey="185" pollutantname="Naphthalene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="23" pollutantname="Naphthalene particle" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="23" pollutantname="Naphthalene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1"
processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11"
processname="Evap Permeation"/>
  <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13"
processname="Evap Fuel Leaks"/>
  <pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="111" pollutantname="Organic Carbon" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="183" pollutantname="Phenanthrene gas" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="183" pollutantname="Phenanthrene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="83" pollutantname="Phenanthrene particle" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="83" pollutantname="Phenanthrene particle" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="1"
processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="100" pollutantname="Primary Exhaust PM10 - Total" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="1"
processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="110" pollutantname="Primary Exhaust PM2.5 - Total" processkey="15"
processname="Crankcase Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="184" pollutantname="Pyrene gas" processkey="1" processname="Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="184" pollutantname="Pyrene gas" processkey="15" processname="Crankcase
Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="84" pollutantname="Pyrene particle" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="84" pollutantname="Pyrene particle" processkey="15" processname="Crankcase
Running Exhaust"/>
  <pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="1" processname="Running
Exhaust"/>
  <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1"
processname="Running Exhaust"/>

```

```

    <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11"
processname="Evap Permeation"/>
    <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13"
processname="Evap Fuel Leaks"/>
    <pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15"
processname="Crankcase Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1"
processname="Running Exhaust"/>
    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11"
processname="Evap Permeation"/>
    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13"
processname="Evap Fuel Leaks"/>
    <pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15"
processname="Crankcase Running Exhaust"/>
  </pollutantprocessassociations>
  <databaseselections>
    <databaseselection servername="" databasename="MOVES2014_early_NLEV_MWCOG" description=""/>
  </databaseselections>
  <internalcontrolstrategies>
<internalcontrolstrategy
classname="gov.epa.otaq.moves.master.implementation.ghg.intemalcontrolstrategies.rateofprogress.RateOfProgressStrategy
"><![CDATA[
useParameters      No
]]></internalcontrolstrategy>
</internalcontrolstrategies>
<inputdatabase servername="" databasename="" description=""/>
<uncertaintyparameters uncertaintymodeenabled="false" numberofruns persimulation="0" numberofsimulations="0"/>
<geographicoutputdetail description="COUNTY"/>
<outputemissionsbreakdownselection>
  <modelyear selected="false"/>
  <fueltype selected="true"/>
  <emissionprocess selected="false"/>
  <onroadoffroad selected="true"/>
  <roadtype selected="false"/>
  <sourceusetype selected="false"/>
  <movesvehicletype selected="false"/>
  <onroadscc selected="false"/>
  <estimateuncertainty selected="false" numberofiterations="2" keepSampledData="false" keepIterations="false"/>
  <sector selected="false"/>
  <engtechid selected="false"/>
  <hpclass selected="false"/>
  <regclassid selected="false"/>
</outputemissionsbreakdownselection>
<outputdatabase servername="" databasename="Output database name" description=""/>
<outputtimestep value="24-Hour Day"/>
<outputvmtdata value="true"/>
<outputsho value="false"/>
<outputsh value="false"/>
<outputshp value="false"/>
<outputshidling value="false"/>
<outputstarts value="false"/>
<outputpopulation value="false"/>
<scaleinputdatabase servername="localhost" databasename="Input database name" description=""/>
<pmsize value="0"/>
<outputfactors>
  <timefactors selected="true" units="Days"/>
  <distancefactors selected="true" units="Miles"/>

```

```
<massfactors selected="true" units="Grams" energyunits="Million BTU"/>
</outputfactors>
<savedata>
</savedata>
<donotexecute>
</donotexecute>
<generatordatabase shouldsave="false" servemame="" databasename="" description=""/>
  <donotperformfinalaggregation selected="false"/>
<lookuptableflags scenarioid="" truncateoutput="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
```

**Link Sample Input Table**

- Separate files provided for each time period

linkID	countyID	zoneID	roadTypeID	linkLength	linkVolume	linkAvgSpeed	linkDescription	linkAvgGrade
1	51510	51510	4	0.04	1200	25	Northbound Link 1	0
2	51510	51510	4	0.05	300	55	Northbound Link 2	-3.56

**Link Source Type Distribution Sample Input Table**

- Separate files provided for each time period to disaggregate link volumes to the MOVES source type definitions

linkID	sourceTypeID	sourceTypeHourFraction
1	11	0.014879
1	21	0.623485
1	31	0.269622
1	32	0.083692
1	41	0.000381
1	42	0.001143
1	43	0.001502
1	51	7.03E-05
1	52	0.003011
1	53	0.000236
1	54	0.000267
1	61	0.001023
1	62	0.000687
2	11	0.014879
2	21	0.623485
2	31	0.269622
2	32	0.083692
2	41	0.000381
2	42	0.001143
2	43	0.001502
2	51	7.03E-05
2	52	0.003011
2	53	0.000236
2	54	0.000267
2	61	0.001023
2	62	0.000687

**Link Drive Schedule Sample Input Table**

- <Optional> input
- Requires detailed traffic simulation/drive cycle data

linkID	secondID	speed	grade
1	1	0	0.05
1	2	5	0.05
1	3	11	0.05
1	4	16	0.05
1	5	21	0.05
1	6	25	0.05
1	7	30	0.05
1	8	34	0.05
1	9	39	0.05
1	10	45	0.05
2	1	0	0.76
2	2	4	0.76
2	3	8	0.76
2	4	12	0.76
2	5	15	0.76
2	6	19	0.76
2	7	22	0.76

**Operating Mode Distribution Sample Input Table**

- <Optional> input
- Requires detailed traffic simulation/drive cycle data

sourceTypeID	hourDayID	linkID	polProcessID	opModeID	opModeFraction
21	15	1	9102	101	0.05
21	15	1	9102	106	0.05
21	15	1	9102	107	0.8
21	15	1	9102	108	0.1
21	15	1	11002	101	0.05
21	15	1	11002	106	0.05
21	15	1	11002	107	0.8
21	15	1	11002	108	0.1
21	15	1	11016	101	0.05
21	15	1	11016	106	0.05
21	15	1	11016	107	0.8
21	15	1	11016	108	0.1
21	15	1	11102	101	0.05
21	15	1	11102	106	0.05
21	15	1	11102	107	0.8
21	15	1	11102	108	0.1

**Off-Network Link Sample Input Table**

- <Optional> input
- Only required if off-network sources produce significant idling or start emissions

sourceTypeID	vehiclePopulation	startFraction	extendedIdleFraction	parkedVehicleFraction
11	0	0	0	
21	421	1	0	
31	216	1	0	
32	0	0	0	
41	0	0	0	
42	0	0	0	
43	0	0	0	
51	0	0	0	
52	0	0	0	
53	0	0	0	
54	0	0	0	
61	0	0	0	
62	0	0	0	

**Source Type Age Distribution Sample Input Table**

- Typically based on local MOVES data used for regional conformity or SIPs

SourceTypeID	YearID	AgeID	AgeFraction
11	2015	0	0.0280944
11	2015	1	0.0415917
11	2015	2	0.0941812
11	2015	3	0.0930814
11	2015	4	0.10128
11	2015	5	0.0994801
11	2015	6	0.070186
11	2015	7	0.0690862
11	2015	8	0.0959808
11	2015	9	0.054989
11	2015	10	0.0409918
11	2015	11	0.0362927
11	2015	12	0.0268946
11	2015	13	0.0280944
11	2015	14	0.0104979
11	2015	15	0.0163967
11	2015	16	0.00879824
11	2015	17	0.00759848
11	2015	18	0.00589882
11	2015	19	0.00589882
11	2015	20	0.00229954
11	2015	21	0.00529894
11	2015	22	0.00529894
11	2015	23	0.00409918
11	2015	24	0.00317106
11	2015	25	0.00245309
11	2015	26	0.00189767
11	2015	27	0.00146801

11	2015	28	0.00113563
11	2015	29	0.000878506
11	2015	30	0.0366865
21	2015	0	0.0907091
21	2015	1	0.0866087
21	2015	2	0.0725072
21	2015	3	0.060506
21	2015	4	0.0683068
21	2015	5	0.0640064
21	2015	6	0.0610061
21	2015	7	0.060106
21	2015	8	0.0616062
21	2015	9	0.0561056
21	2015	10	0.0493049
21	2015	11	0.0493049
21	2015	12	0.0411041
21	2015	13	0.0350035
21	2015	14	0.030103
21	2015	15	0.0216022
21	2015	16	0.0223022
21	2015	17	0.0161016
21	2015	18	0.0123012
<b>(Incomplete Data – Shown For Format Only)</b>			

**Fuel Supply Sample Input Table (MOVES 2014 format)**

- Typically based on local MOVES data used for regional conformity or SIPs

fuelRegionID	fuelyearID	monthGroupID	fuelFormulationID	marketShare	marketShareCV
1270011000	2015	1	3302	1	0.5
1270011000	2015	1	25005	1	0.5
1270011000	2015	1	27001	1	0.5
1270011000	2015	2	3302	1	0.5
1270011000	2015	2	25005	1	0.5
1270011000	2015	2	27001	1	0.5
1270011000	2015	3	3302	1	0.5
1270011000	2015	3	25005	1	0.5
1270011000	2015	3	27001	1	0.5
1270011000	2015	4	25005	1	0.5
1270011000	2015	4	27002	1	0.5
1270011000	2015	5	3301	1	0.5
1270011000	2015	5	3303	0	0.5
1270011000	2015	5	25005	1	0.5
1270011000	2015	5	27002	1	0.5
1270011000	2015	6	3301	1	0.5
1270011000	2015	6	3303	0	0.5
1270011000	2015	6	25005	1	0.5
1270011000	2015	6	27002	1	0.5
1270011000	2015	7	3301	1	0.5
1270011000	2015	7	3303	0	0.5
1270011000	2015	7	25005	1	0.5
1270011000	2015	7	27002	1	0.5
1270011000	2015	8	3301	1	0.5
1270011000	2015	8	3303	0	0.5

1270011000	2015	8	25005	1	0.5
1270011000	<b>2015</b>	<b>8</b>	<b>27002</b>	<b>1</b>	<b>0.5</b>
1270011000	2015	9	3301	1	0.5
1270011000	<b>2015</b>	<b>9</b>	<b>3303</b>	<b>0</b>	<b>0.5</b>
1270011000	2015	9	25005	1	0.5
1270011000	<b>2015</b>	<b>9</b>	<b>27002</b>	<b>1</b>	<b>0.5</b>
1270011000	2015	10	25005	1	0.5
1270011000	<b>2015</b>	<b>10</b>	<b>27002</b>	<b>1</b>	<b>0.5</b>
1270011000	2015	11	3302	1	0.5
1270011000	<b>2015</b>	<b>11</b>	<b>25005</b>	<b>1</b>	<b>0.5</b>
1270011000	2015	11	27001	1	0.5
1270011000	<b>2015</b>	<b>12</b>	<b>3302</b>	<b>1</b>	<b>0.5</b>
1270011000	2015	12	25005	1	0.5
1270011000	<b>2015</b>	<b>12</b>	<b>27001</b>	<b>1</b>	<b>0.5</b>

**Meteorology Sample Input Table**

- Typically based on local MOVES data used for regional conformity or SIPs

monthID	zoneID	HourID	temperature	relHumidity
1	515100	7	33.0	68.8

**Fuel Formulation Sample Input Table (MOVES2010b/MOVES2014 format)**

- Typically based on local MOVES data used for regional conformity or SIPs

Fuel Formulation ID	Fuel Subtype ID	RVP	Sulfur Level	ETOH Volume	MTBE Volume	ETBE Volume	TAME Volume	Aromatic Content	Olefin Content	Benzene Content	e200	e300	volToWt Percent Oxy	BioDiesel Ester Volume	Cetane Index	PAH Content	T50	T90
30	30		0	0	0	0	0	0	0	0	0	0		0	0	0		
426	12	6.935	32.5	9.705	0.005	0	0	16.245	13.855	0.532	49.15	84.6		0	0	0	201.5	322.136
486	12	6.935	10	9.705	0.005	0	0	16.245	13.855	0.532	49.15	84.6		0	0	0	201.5	322.136
427	12	13.4268	33.5	10.075	0	0	0	15.78	10.235	0.5235	56.55	86.55		0	0	0	186.4	313.273
487	12	13.4268	10	10.075	0	0	0	15.78	10.235	0.5235	56.55	86.55		0	0	0	186.4	313.273
20011	20		11	0	0	0	0	0	0	0	0	0		0	0	0		

**I/M Programs Sample Input Table**

- Typically based on local MOVES data used for regional conformity or SIPs

polProcessID	stateID	countyID	yearID	sourceTypeID	fuelTypeID	IMProgramID	inspectFreq	testStandardsID	begModelYearID	endModelYearID	useIMyn	complianceFactor
101	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
101	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
101	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731
102	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
102	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
102	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731
201	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
201	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
201	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731
202	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
202	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
202	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731
301	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
301	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
301	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731

302	51	51510	2015	21	1	10	1968	1983	2	12	Y	97.713
302	51	51510	2015	31	1	10	1968	1983	2	12	Y	94.7816
302	51	51510	2015	32	1	10	1968	1983	2	12	Y	90.8731
101	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
101	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
101	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
102	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
102	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
102	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
201	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
201	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
201	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
202	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
202	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
202	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
301	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
301	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
301	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
302	51	51510	2015	21	1	11	1984	1995	2	26	Y	97.713
302	51	51510	2015	31	1	11	1984	1995	2	26	Y	94.7816
302	51	51510	2015	32	1	11	1984	1995	2	26	Y	90.8731
101	51	51510	2015	21	1	12	1996	2011	2	51	Y	97.713
101	51	51510	2015	31	1	12	1996	2011	2	51	Y	94.7816
101	51	51510	2015	32	1	12	1996	2011	2	51	Y	90.8731
102	51	51510	2015	21	1	12	1996	2011	2	51	Y	97.713
102	51	51510	2015	31	1	12	1996	2011	2	51	Y	94.7816

(Incomplete Data – Shown For Format Only)

# Project-Level Air Quality Analysis Resource Document

## APPENDIX J2: CAL3QHC INPUT DATA

Below is an input template for NOVA region. The template includes the default worst-case parameters listed in **Appendix G1**. Inputs highlighted in yellow will need to be reviewed/updated per project data.

### CAL3QHC Input Parameter File: NOVA Region (Urban Area)

'NOVA Example' 6017500 60.30481 1 *[Title, averaging period, surface roughness, settling velocity, deposition velocity, numbers of receptors, conversion factor (feet to meters), output units (1=feet, 0=meters), Debugging Option (1=yes, 0=no)]*

'RCP 1' 207006.4 317332.6 5.9  
 'RCP 2' 207036.9 317363.1 5.9  
 'RCP 3' 207036.9 317393.6 5.9  
 'RCP 4' 207067.4 317393.6 5.9  
 'RCP 5' 207067.4 317424.5 5.9  
 'RCP 6' 207067.4 317454.5 5.9

} *[Receptors]*

'NOVA Example Links' 6 1 0 'c' *[Run Title, number of links, number of met conditions, output type (1=receptor link matrix, 0=summary), Pollutant]*

1 *[Link Type 1= Freeflow, 2= queue]*  
 'NorthboundThru APP' 'AG' 207085.5 317520.2 207049.7 317450.9 1230 1.5 0 32  
 1  
 'NorthboundThru DEP' 'AG' 207090.2 317524.8 207143.5 317588.7 1230 1.3 0 32  
 1  
 'SouthboundThru APP' 'AG' 207114.5 317590.2 207085.9 317550.4 1230 1.6 0 32  
 1  
 'SouthboundThru DEP' 'AG' 207084.7 317547.7 207062.2 317511.9 1230 1.5 0 32  
 2  
 'NorthboundThru Queue' 'AG' 207085.5 317520.2 207049.7 317450.9 0 12 1  
 120 68 2 1230 3.5 1900 1 3  
 2  
 'SouthboundThru Queue' 'AG' 207114.5 317590.2 207085.9 317550.4 0 12 1  
 120 68 2 1230 3.5 1900 1 3  
 2  
 'Northbound Left Queue' 'AG' 207082.6 317521.9 207060.9 317483.1 0 12 1  
 120 68 2 1230 3.5 1900 1 3

*[Name, Type (AG=At Grade, FL=Fill, BR=Bridge, DP=Depressed), X1, Y1, X2, Y2, volume, emission factor, source height, mixing zone width]*

*\*First Line\* [Name, Type (AG=At Grade, FL=Fill, BR=Bridge, DP=Depressed), X1, Y1, X2, Y2, Source height, mixing zone width, number of lanes],*  
*\*Second Line\* [average red time, cycle length, average clearance lost time, volume, emission factor, saturation flow rate, signal type, arrival rate]*

10 4 1000 0 'Y' 10 1 36 *[Wind and basic met data]*

## APPENDIX J3: CAL3QHCR INPUT DATA

### Control File:

#### a. Sample file 1 – For jurisdictions using DCA airport met data as assigned in Appendix I1:

CAL3QHCR\_DCA\_SampleQ1.msg *[Message file]*  
 CheaterControlFile\_DCA\_SampleQ1.inp *[Input data file]*  
 DCA\_1991.met *[Input meteorological data file, see Appendix I1]*  
 CAL3QHCR\_DCA\_SampleQ1.et1  
 CAL3QHCR\_DCA\_SampleQ1.et2  
 CAL3QHCR\_DCA\_SampleQ1.out  
 CAL3QHCR\_DCA\_SampleQ1.ilc

#### b. Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I1:

CAL3QHCR\_IAD\_SampleQ1.msg *[Message file]*  
 CheaterControlFile\_IAD\_SampleQ1.inp *[Input data file]*  
 IAD\_1991.met *[Input meteorological data file, see Appendix I1]*  
 CAL3QHCR\_IAD\_SampleQ1.et1  
 CAL3QHCR\_IAD\_SampleQ1.et2  
 CAL3QHCR\_IAD\_SampleQ1.out  
 CAL3QHCR\_IAD\_SampleQ1.ilc

### CAL3QHCR Input Data File:

```
'2015 Test with 1991 Q1 Met',60,175,0,0,6,0.3048,0
1,1, 1991,3,31,1991
93738, 91, 93734,91
1,0,'U'
'RCP 1',1591.2,633.2,5
'RCP 2',1472.1,1224.4,5
'RCP 3',936,2528.2,5
'RCP 4',732,1426.5,5
'RCP 5',1328.7,554.5,5
'RCP 6',1683.7,43,5
2,'P',
1,1,1,1,1,1,
'1st Quarter - 1991',6
1,1,
'NB Freeway Segment 1','AG',1971.5,-289,1478.7,651.2,0,67.7
2,1,
'NB Freeway Segment 2','AG',1478.7,651.1,1349.7,965.6,0,67.7
3,1,
'NB Freeway Segment 3','AG',1349.7,965.6,652.6,2838.6,0,67.7
4,1
'SB Freeway Segment 1','AG',613.8,2828.4,1304.5,957.7,0,67.7
5,1,
```

} *[Receptors]*

} *[Link Information]*

```
'SB Freeway Segment 2','AG',1304.5,957.7,1499,496.4,0,67.7
6,1,
'SB Freeway Segment 3','AG',1499,496.4,1939.3,-309.1,0,67.7
1,0,
1,2775,0.044152
2,2519,0.044179
3,2519,0.044179
4,1960,0.044214
5,1960,0.044214
6,2337,0.028208
2,0,
1,2775,0.044152
2,2519,0.044179
3,2519,0.044179
4,1960,0.044214
5,1960,0.044214
6,2337,0.028208
```

*[Hourly traffic volume and emission factors]*

*[Hourly traffic volume and emission factors - continued]*

<File not complete>

**CAL3QHCR Meteorology Input Data:**

**a. Sample file 1 – For jurisdictions using DCA airport met data as assigned in Appendix I1:**

```
13743 91 93734 91
91 1 1 1 191.0000 4.1155 272.0 5 1209.2 155.0
91 1 1 2 218.0000 5.1444 272.6 5 1205.2 155.0
91 1 1 3 214.0000 5.6588 272.0 4 1201.3 1201.3
91 1 1 4 223.0000 5.1444 272.0 5 1197.4 155.0
91 1 1 5 243.0000 4.6300 271.5 5 1193.4 155.0
91 1 1 6 242.0000 3.0866 270.9 6 1189.5 155.0
91 1 1 7 255.0000 2.0578 270.9 6 1185.6 155.0
91 1 1 8 283.0000 1.5433 270.9 5 74.4 219.5
91 1 1 9 237.0000 2.5722 273.1 4 255.0 375.9
91 1 110 301.0000 1.0289 274.3 3 435.6 532.3
91 1 111 4.0000 1.0289 275.9 2 616.2 688.7
91 1 112 46.0000 2.0578 277.0 3 796.8 845.2
91 1 113 13.0000 1.5433 277.6 2 977.4 1001.6
91 1 114 349.0000 4.1155 278.7 3 1158.0 1158.0
91 1 115 22.0000 3.0866 278.7 3 1158.0 1158.0
91 1 116 354.0000 2.5722 278.2 4 1158.0 1158.0
91 1 117 1.0000 2.5722 276.5 5 1155.6 1144.7
91 1 118 27.0000 2.5722 276.5 6 1128.6 993.9
91 1 119 64.0000 1.0289 275.9 7 1101.7 843.1
91 1 120 287.0000 1.0289 275.4 7 1074.7 692.3
91 1 121 10.0000 1.5433 273.7 7 1047.7 541.4
91 1 122 82.0000 1.5433 274.3 6 1020.7 390.6
91 1 123 220.0000 1.0289 274.8 6 993.7 239.8
91 1 124 220.0000 0.0000 272.6 7 966.7 89.0
```

91 1 2 1	156.0000	2.0578	272.6 6	940.0	89.0
91 1 2 2	162.0000	0.0000	272.6 7	913.0	89.0
91 1 2 3	162.0000	0.0000	271.5 7	886.0	89.0
91 1 2 4	160.0000	0.0000	270.4 7	859.0	89.0
91 1 2 5	156.0000	3.0866	270.4 6	832.0	89.0
91 1 2 6	167.0000	3.6011	270.4 5	805.0	89.0
91 1 2 7	159.0000	1.0289	270.9 6	778.0	89.0
91 1 2 8	166.0000	3.0866	270.9 5	37.7	121.0
91 1 2 9	170.0000	3.0866	274.3 4	129.6	199.0
91 1 210	161.0000	3.0866	276.5 3	221.5	277.0
91 1 211	165.0000	2.5722	278.7 3	313.3	355.0
91 1 212	151.0000	4.1155	279.8 3	405.2	433.0
91 1 213	259.0000	1.5433	282.0 2	497.1	511.0
91 1 214	307.0000	2.0578	282.6 3	589.0	589.0
91 1 215	300.0000	1.0289	283.2 2	589.0	589.0
91 1 216	334.0000	1.0289	283.2 3	589.0	589.0
91 1 217	178.0000	2.5722	282.0 4	587.3	587.3
91 1 218	141.0000	4.1155	281.5 5	565.3	509.5
91 1 219	112.0000	3.0866	282.0 6	543.3	435.6
91 1 220	215.0000	1.5433	278.2 7	521.3	361.7
91 1 221	324.0000	1.0289	277.6 7	499.3	287.8
91 1 222	5.0000	3.6011	276.5 6	477.3	213.8
91 1 223	7.0000	3.0866	275.9 6	455.2	139.9
91 1 224	358.0000	2.5722	275.4 6	433.2	66.0
91 1 3 1	360.0000	0.0000	274.8 7	411.4	66.0
91 1 3 2	356.0000	0.0000	274.8 7	389.4	66.0
91 1 3 3	4.0000	0.0000	274.3 7	367.3	66.0
91 1 3 4	360.0000	0.0000	274.3 7	345.3	66.0
91 1 3 5	357.0000	3.0866	273.7 6	323.3	66.0
91 1 3 6	59.0000	3.0866	273.7 6	301.2	66.0
91 1 3 7	6.0000	2.0578	273.7 5	279.2	66.0
91 1 3 8	9.0000	2.0578	274.3 4	8.0	69.8
91 1 3 9	8.0000	0.0000	275.9 3	27.5	79.0
91 1 310	354.0000	1.0289	277.6 4	47.0	88.2
91 1 311	202.0000	3.0866	279.8 3	66.5	97.4
91 1 312	208.0000	5.6588	281.5 4	86.0	106.6
91 1 313	161.0000	5.6588	280.9 4	105.5	115.8
91 1 314	152.0000	6.1733	279.8 4	125.0	125.0
91 1 315	147.0000	5.6588	279.8 4	125.0	125.0
91 1 316	130.0000	5.6588	279.3 4	125.0	125.0
91 1 317	159.0000	4.1155	278.7 4	127.1	127.1
91 1 318	131.0000	4.1155	278.2 4	161.0	161.0
91 1 319	127.0000	4.1155	278.2 4	194.8	194.8
91 1 320	148.0000	5.1444	278.2 4	228.7	228.7
91 1 321	157.0000	4.6300	277.6 4	262.5	262.5
91 1 322	159.0000	4.1155	277.0 4	296.4	296.4
91 1 323	161.0000	5.6588	276.5 4	330.2	330.2
91 1 324	157.0000	4.6300	275.9 4	364.1	364.1

<File not complete>

**b. Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I1:**

93738 91 93734 91  
91 1 1 1 241.0000 1.5433 269.3 7 1209.1 155.0  
91 1 1 2 198.0000 2.5722 267.6 6 1205.2 155.0  
91 1 1 3 94.0000 2.0578 266.5 6 1201.2 155.0  
91 1 1 4 173.0000 2.0578 267.6 6 1197.3 155.0  
91 1 1 5 173.0000 0.0000 266.5 7 1193.4 155.0  
91 1 1 6 172.0000 0.0000 265.9 7 1189.4 155.0  
91 1 1 7 175.0000 0.0000 265.4 7 1185.5 155.0  
91 1 1 8 303.0000 1.5433 265.9 6 78.6 223.1  
91 1 1 9 297.0000 0.0000 269.3 5 258.5 378.9  
91 1 1 10 51.0000 1.5433 271.5 4 438.4 534.7  
91 1 1 11 14.0000 2.0578 274.3 3 618.3 690.6  
91 1 1 12 356.0000 4.6300 274.8 3 798.2 846.4  
91 1 1 13 13.0000 3.6011 275.4 4 978.1 1002.2  
91 1 1 14 29.0000 4.1155 276.5 3 1158.0 1158.0  
91 1 1 15 2.0000 3.6011 276.5 4 1158.0 1158.0  
91 1 1 16 4.0000 4.1155 277.0 4 1158.0 1158.0  
91 1 1 17 51.0000 2.5722 274.8 5 1154.7 1139.5  
91 1 1 18 17.0000 1.5433 272.6 6 1127.7 989.4  
91 1 1 19 164.0000 2.0578 270.4 6 1100.8 839.4  
91 1 1 20 307.0000 1.5433 269.8 7 1073.9 689.3  
91 1 1 21 340.0000 1.5433 269.3 7 1046.9 539.2  
91 1 1 22 342.0000 0.0000 268.1 7 1020.0 389.1  
91 1 1 23 340.0000 0.0000 267.6 7 993.1 239.1  
91 1 1 24 340.0000 0.0000 267.0 7 966.1 89.0  
91 1 2 1 336.0000 0.0000 266.5 7 939.4 89.0  
91 1 2 2 342.0000 0.0000 266.5 7 912.4 89.0  
91 1 2 3 342.0000 0.0000 265.9 7 885.5 89.0  
91 1 2 4 340.0000 0.0000 265.9 7 858.5 89.0  
91 1 2 5 156.0000 1.5433 265.9 7 831.6 89.0  
91 1 2 6 157.0000 0.0000 265.9 7 804.6 89.0  
91 1 2 7 159.0000 0.0000 265.9 7 777.7 89.0  
91 1 2 8 156.0000 0.0000 265.9 6 39.8 122.8  
91 1 2 9 160.0000 2.5722 269.3 5 131.4 200.5  
91 1 2 10 171.0000 2.0578 272.6 4 222.9 278.2  
91 1 2 11 185.0000 2.0578 275.4 3 314.4 355.9  
91 1 2 12 181.0000 2.0578 277.0 3 405.9 433.6  
91 1 2 13 189.0000 2.0578 279.3 3 497.5 511.3  
91 1 2 14 167.0000 2.0578 281.5 3 589.0 589.0  
91 1 2 15 170.0000 2.5722 282.0 3 589.0 589.0  
91 1 2 16 184.0000 1.5433 282.6 3 589.0 589.0  
91 1 2 17 158.0000 1.5433 280.4 4 586.6 586.6  
91 1 2 18 51.0000 1.5433 276.5 5 564.6 507.3  
91 1 2 19 22.0000 1.5433 273.1 6 542.6 433.8  
91 1 2 20 25.0000 0.0000 272.6 7 520.6 360.2  
91 1 2 21 24.0000 0.0000 272.0 7 498.7 286.7  
91 1 2 22 25.0000 0.0000 271.5 7 476.7 213.1  
91 1 2 23 17.0000 1.5433 271.5 7 454.7 139.6

91 1 224	18.0000	0.0000	270.9 7	432.7	66.0
91 1 3 1	20.0000	0.0000	270.4 7	410.9	66.0
91 1 3 2	16.0000	0.0000	269.3 7	388.9	66.0
91 1 3 3	24.0000	0.0000	269.8 7	366.9	66.0
91 1 3 4	350.0000	2.0578	269.3 6	344.9	66.0
91 1 3 5	7.0000	2.0578	269.8 6	322.9	66.0
91 1 3 6	59.0000	2.0578	269.3 6	300.9	66.0
91 1 3 7	306.0000	1.5433	270.9 7	279.0	66.0
91 1 3 8	199.0000	1.5433	272.6 6	8.4	70.0
91 1 3 9	198.0000	0.0000	273.7 5	27.9	79.1
91 1 310	164.0000	2.0578	275.4 4	47.3	88.3
91 1 311	152.0000	3.6011	278.2 4	66.7	97.5
91 1 312	168.0000	3.6011	278.7 4	86.1	106.7
91 1 313	181.0000	4.6300	279.3 4	105.6	115.8
91 1 314	182.0000	3.0866	278.2 4	125.0	125.0
91 1 315	157.0000	4.1155	278.2 4	125.0	125.0
91 1 316	190.0000	3.6011	277.6 4	125.0	125.0
91 1 317	179.0000	3.0866	277.0 4	128.3	128.3
91 1 318	171.0000	3.6011	276.5 4	162.1	162.1
91 1 319	187.0000	2.0578	275.9 4	195.9	195.9
91 1 320	168.0000	2.5722	275.9 4	229.7	229.7
91 1 321	147.0000	3.0866	275.9 4	263.5	263.5
91 1 322	159.0000	1.5433	275.4 4	297.3	297.3
91 1 323	161.0000	3.0866	274.8 4	331.1	331.1
91 1 324	147.0000	2.5722	273.7 5	364.9	683.0
91 1 4 1	146.0000	0.0000	272.6 6	398.4	683.0
91 1 4 2	166.0000	1.5433	271.5 6	432.2	683.0
91 1 4 3	178.0000	2.5722	270.9 5	466.0	683.0
91 1 4 4	209.0000	4.1155	271.5 5	499.8	683.0
91 1 4 5	191.0000	2.0578	270.4 6	533.6	683.0
91 1 4 6	132.0000	2.0578	269.8 6	567.5	683.0
91 1 4 7	186.0000	1.5433	269.8 7	601.3	683.0
91 1 4 8	128.0000	2.0578	269.3 6	56.4	693.4
91 1 4 9	196.0000	3.6011	271.5 5	186.7	717.5
91 1 410	157.0000	4.1155	272.6 4	316.9	741.6
91 1 411	157.0000	4.6300	274.3 3	447.2	765.7
91 1 412	133.0000	2.5722	275.4 3	577.5	789.8

<File not complete>

## APPENDIX J4: AERMOD INPUT DATA

### Input Runstream File:

#### **a. Sample file 1 – For jurisdictions using DCA airport met data as assigned in Appendix I2:**

##### ***[Control Pathway- Information about the run]***

CO STARTING  
 CO TITLEONE Example VA project  
 CO MODELOPT CONC FLAT  
 CO POLLUTID PM2.5  
 CO AVERTIME ANNUAL  
 CO URBANOPT 140000  
 CO FLAGPOLE 1.8  
 CO RUNORNOT RUN  
 CO FINISHED

##### ***[Source Pathway- Information about each source type, location, and emission factors]***

SO STARTING  
 SO ELEVUNIT METERS  
 \*\* SRCDESCR NB Segment 1  
 SO LOCATION 1 AREAPOLY 984924.86 491156.04 0  
 \*\* SRCDESCR NB Segment 2  
 SO LOCATION 2 AREAPOLY 985035 491018.83 0  
 \*\* SRCDESCR NB Segment 3  
 SO LOCATION 3 AREAPOLY 985406.45 490732.12 0  
 \*\* SRCDESCR NB Segment 4  
 SO LOCATION 4 AREAPOLY 985241.6 490863.57 0  
 \*\* SRCDESCR SB Segment 5  
 SO LOCATION 5 AREAPOLY 985269.97 490769.13 0  
 \*\* SRCDESCR SB Segment 6  
 SO LOCATION 6 AREAPOLY 985167.95 490776.63 0

SO SRCPARAM 1 1 1.7 20 1.6  
 SO SRCPARAM 2 1 1.3 9 1.2  
 SO SRCPARAM 3 1 1.7 4 1.6  
 SO SRCPARAM 4 1 1.7 4 1.6  
 SO SRCPARAM 5 1 1.4 20 1.3  
 SO SRCPARAM 6 1 1.4 19 1.3

SO AREAVERT 1 984924.86 491156.04 984915.75 491150.85 984780.92 491269.75 984777 491266.08  
 984685.43 491349.56 984660.48 491374.02 984617.61 491419.36 984590.67 491449.94 984566.36  
 491480.86 984526.57 491536.24 984507.86 491567.41 984464.05 491651.52 984473.19 491654.25  
 984483.56 491632.88 984497.35 491605.81 984512.15 491580.89 984543.39 491529.29 984598.91  
 491454.92 984634.46 491415.96 984669.24 491380.29  
 SO AREAVERT 2 985035 491018.83 985024.25 491011.11 984973.88 491069.61 984896.83 491149.66  
 984850.88 491194.97 984777.2 491265.81 984780.6 491269.02 984886.09 491168.56 984990.29 491062.52  
 SO AREAVERT 3 985406.45 490732.12 985400.71 490724.53 985241.6 490863.57 985257.74 490864.4  
 SO AREAVERT 4 985241.6 490863.57 984915.68 491150.86 984925 491155.99 985257.74 490864.4

SO AREAVERT 5 985269.97 490769.13 985269.7 490773.67 985273.14 490773.46 985293.05 490771  
 985311.98 490767.15 985325.17 490763.3 985338.2 490758.55 985355 490751.08 985375.24 490739.83  
 985387.04 490731.36 985408.82 490714.8 985440.22 490688.35 985438.16 490685.63 985391.4 490724.05  
 985359.25 490744.65 985343.11 490751.91 985330 490757.16 985313.78 490762.48 985287.81 490767.73  
 985272.4 490769.17

SO AREAVERT 6 985167.95 490776.63 985168.6 490770.43 985162.8 490772.24 985150.16 490779.28  
 985141.72 490785.75 985133.69 490792.63 985125.56 490802.01 985111.9 490828.77 985106.17  
 490839.99 985098.55 490885 985102.26 490885.47 985110.1 490847.45 985113.21 490838.68 985120.67  
 490821.23 985125.63 490811.7 985134.11 490800.12 985146.38 490788.67 985157.13 490781.82  
 985163.27 490778.62

SO URBANSRC 1 2 3 4 5 6

SO EMISFACT 1 SEASHR 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.72108E-07 1.72108E-  
 07 1.72108E-07

SO EMISFACT 1 SEASHR 1.72108E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-  
 07 2.6431E-07

SO EMISFACT 1 SEASHR 2.6431E-07 2.6431E-07 2.6431E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07  
 1.37163E-07

SO EMISFACT 1 SEASHR 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-08 1.02583E-07 1.02583E-  
 07 1.02583E-07

SO EMISFACT 1 SEASHR 1.02583E-07 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-  
 08 1.71192E-07

SO EMISFACT 1 SEASHR 1.71192E-07 1.71192E-07 1.71192E-07 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-  
 08 8.40898E-08

SO EMISFACT 1 SEASHR 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-08 8.92813E-08 8.92813E-  
 08 8.92813E-08

SO EMISFACT 1 SEASHR 8.92813E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-  
 08 1.65657E-07

SO EMISFACT 1 SEASHR 1.65657E-07 1.65657E-07 1.65657E-07 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-  
 08 7.43689E-08

SO EMISFACT 1 SEASHR 1.12851E-07 1.12851E-07 1.12851E-07 1.12851E-07 1.12851E-07 1.40236E-07 1.40236E-  
 07 1.40236E-07

SO EMISFACT 1 SEASHR 1.40236E-07 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-  
 08 9.15772E-08

<SO EMISFACT Section Not Complete>

SO SRCGROUP ALL

SO FINISHED

***[Receptor Pathway- Information about receptor number and locations]***

RE STARTING

RE ELEVUNIT METERS

RE INCLUDED Receptors\_Sample.txt

RE FINISHED

***[Meteorology Pathway- Information about names of met data files and data sources]***

ME STARTING

ME SURFFILE DCA\_2009.SFC

ME PROFFILE DCA\_2009.PFL

ME SURFDATA 13743 2009

ME UAIRDATA 13734 2009  
 ME PROFBASE 0  
 ME FINISHED

***[Output Pathway- Information about outputs]***

OU STARTING  
 OU POSTFILE ANNUAL ALL PLOT VA\_test.pst  
 OU FINISHED

**b. Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I2:**

***[Control Pathway- Information about the run]***

CO STARTING  
 CO TITLEONE ExampleVAproject  
 CO MODELOPT CONC FLAT  
 CO POLLUTID PM2.5  
 CO AVERTIME ANNUAL  
 CO URBANOPT 140000  
 CO FLAGPOLE 1.8  
 CO RUNORNOT RUN  
 CO FINISHED

***[Source Pathway- Information about each source type, location, and emission factors]***

SO STARTING  
 SO ELEVUNIT METERS  
 \*\* SRCDESCR NB Segment 1  
 SO LOCATION 1 AREAPOLY 984924.86 491156.04 0  
 \*\* SRCDESCR NB Segment 2  
 SO LOCATION 2 AREAPOLY 985035 491018.83 0  
 \*\* SRCDESCR NB Segment 3  
 SO LOCATION 3 AREAPOLY 985406.45 490732.12 0  
 \*\* SRCDESCR NB Segment 4  
 SO LOCATION 4 AREAPOLY 985241.6 490863.57 0  
 \*\* SRCDESCR SB Segment 5  
 SO LOCATION 5 AREAPOLY 985269.97 490769.13 0  
 \*\* SRCDESCR SB Segment 6  
 SO LOCATION 6 AREAPOLY 985167.95 490776.63 0

SO SRCPARAM 1 1 1.7 20 1.6  
 SO SRCPARAM 2 1 1.3 9 1.2  
 SO SRCPARAM 3 1 1.7 4 1.6  
 SO SRCPARAM 4 1 1.7 4 1.6  
 SO SRCPARAM 5 1 1.4 20 1.3  
 SO SRCPARAM 6 1 1.4 19 1.3

SO AREAVERT 1 984924.86 491156.04 984915.75 491150.85 984780.92 491269.75 984777 491266.08  
 984685.43 491349.56 984660.48 491374.02 984617.61 491419.36 984590.67 491449.94 984566.36  
 491480.86 984526.57 491536.24 984507.86 491567.41 984464.05 491651.52 984473.19 491654.25  
 984483.56 491632.88 984497.35 491605.81 984512.15 491580.89 984543.39 491529.29 984598.91  
 491454.92 984634.46 491415.96 984669.24 491380.29

SO AREAVERT 2 985035 491018.83 985024.25 491011.11 984973.88 491069.61 984896.83 491149.66  
 984850.88 491194.97 984777.2 491265.81 984780.6 491269.02 984886.09 491168.56 984990.29 491062.52  
 SO AREAVERT 3 985406.45 490732.12 985400.71 490724.53 985241.6 490863.57 985257.74 490864.4  
 SO AREAVERT 4 985241.6 490863.57 984915.68 491150.86 984925 491155.99 985257.74 490864.4  
 SO AREAVERT 5 985269.97 490769.13 985269.7 490773.67 985273.14 490773.46 985293.05 490771  
 985311.98 490767.15 985325.17 490763.3 985338.2 490758.55 985355 490751.08 985375.24 490739.83  
 985387.04 490731.36 985408.82 490714.8 985440.22 490688.35 985438.16 490685.63 985391.4 490724.05  
 985359.25 490744.65 985343.11 490751.91 985330 490757.16 985313.78 490762.48 985287.81 490767.73  
 985272.4 490769.17  
 SO AREAVERT 6 985167.95 490776.63 985168.6 490770.43 985162.8 490772.24 985150.16 490779.28  
 985141.72 490785.75 985133.69 490792.63 985125.56 490802.01 985111.9 490828.77 985106.17  
 490839.99 985098.55 490885 985102.26 490885.47 985110.1 490847.45 985113.21 490838.68 985120.67  
 490821.23 985125.63 490811.7 985134.11 490800.12 985146.38 490788.67 985157.13 490781.82  
 985163.27 490778.62

SO URBANSRC 1 2 3 4 5 6

SO EMISFACT 1 SEASHR 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.72108E-07 1.72108E-  
 07 1.72108E-07  
 SO EMISFACT 1 SEASHR 1.72108E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-07 1.08798E-  
 07 2.6431E-07  
 SO EMISFACT 1 SEASHR 2.6431E-07 2.6431E-07 2.6431E-07 1.37163E-07 1.37163E-07 1.37163E-07 1.37163E-07  
 1.37163E-07  
 SO EMISFACT 1 SEASHR 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-08 1.02583E-07 1.02583E-  
 07 1.02583E-07  
 SO EMISFACT 1 SEASHR 1.02583E-07 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-08 7.04398E-  
 08 1.71192E-07  
 SO EMISFACT 1 SEASHR 1.71192E-07 1.71192E-07 1.71192E-07 8.40898E-08 8.40898E-08 8.40898E-08 8.40898E-  
 08 8.40898E-08  
 SO EMISFACT 1 SEASHR 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-08 8.92813E-08 8.92813E-  
 08 8.92813E-08  
 SO EMISFACT 1 SEASHR 8.92813E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-08 6.90832E-  
 08 1.65657E-07  
 SO EMISFACT 1 SEASHR 1.65657E-07 1.65657E-07 1.65657E-07 7.43689E-08 7.43689E-08 7.43689E-08 7.43689E-  
 08 7.43689E-08  
 SO EMISFACT 1 SEASHR 1.12851E-07 1.12851E-07 1.12851E-07 1.12851E-07 1.12851E-07 1.40236E-07 1.40236E-  
 07 1.40236E-07  
 SO EMISFACT 1 SEASHR 1.40236E-07 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-08 9.15772E-  
 08 9.15772E-08

<SO EMISFACT Section Not Complete>

SO SRCGROUP ALL  
 SO FINISHED

**[Receptor Pathway- Information about receptor number and locations]**

RE STARTING  
 RE ELEVUNIT METERS  
 RE INCLUDED Receptors\_Sample.txt  
 RE FINISHED

**[Meteorology Pathway- Information about names of met data files and data sources]**

ME STARTING  
 ME SURFFILE IAD\_2009.SFC  
 ME PROFFILE IAD\_2009.PFL  
 ME SURFDATA 93738 2009  
 ME UAIRDATA 93734 2009  
 ME PROFBASE 0  
 ME FINISHED

**[Output Pathway- Information about outputs]**

OU STARTING  
 OU POSTFILE ANNUAL ALL PLOT VA\_test.pst  
 OU FINISHED

**AERMOD PFL File: [Upper air met data file]**

**a. Sample file 1 – For jurisdictions using DCA airport met data as assigned in Appendix I2:**

9	1	1	1	10.0	1	314.0	6.35	-4.40	99.00	99.00
9	1	1	2	10.0	1	315.0	6.28	-4.40	99.00	99.00
9	1	1	3	10.0	1	306.0	6.01	-4.40	99.00	99.00
9	1	1	4	10.0	1	301.0	6.29	-4.40	99.00	99.00
9	1	1	5	10.0	1	305.0	5.85	-4.40	99.00	99.00
9	1	1	6	10.0	1	306.0	5.48	-4.40	99.00	99.00
9	1	1	7	10.0	1	313.0	5.03	-4.40	99.00	99.00
9	1	1	8	10.0	1	308.0	3.90	-4.40	99.00	99.00
9	1	1	9	10.0	1	319.0	4.48	-3.30	99.00	99.00
9	1	1	10	10.0	1	315.0	5.33	-2.20	99.00	99.00
9	1	1	11	10.0	1	331.0	6.75	-1.10	99.00	99.00
9	1	1	12	10.0	1	330.0	5.22	-1.10	99.00	99.00
9	1	1	13	10.0	1	326.0	3.90	0.60	99.00	99.00
9	1	1	14	10.0	1	318.0	3.52	0.60	99.00	99.00
9	1	1	15	10.0	1	82.0	1.69	0.60	99.00	99.00
9	1	1	16	10.0	1	65.0	2.06	1.10	99.00	99.00
9	1	1	17	10.0	1	221.0	1.76	0.00	99.00	99.00
9	1	1	18	10.0	1	197.0	1.76	-0.60	99.00	99.00
9	1	1	19	10.0	1	184.0	2.36	-1.70	99.00	99.00
9	1	1	20	10.0	1	177.0	4.36	-1.70	99.00	99.00
9	1	1	21	10.0	1	170.0	2.86	-2.20	99.00	99.00
9	1	1	22	10.0	1	169.0	5.01	-1.70	99.00	99.00
9	1	1	23	10.0	1	173.0	5.05	-1.70	99.00	99.00
9	1	1	24	10.0	1	181.0	6.04	-1.70	99.00	99.00
9	1	2	1	10.0	1	194.0	5.04	-1.10	99.00	99.00

<File not complete>

**b. Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I2:**

9	1	1	1	10.0	1	317.0	6.30	-4.40	99.00	99.00
9	1	1	2	10.0	1	321.0	7.42	-5.00	99.00	99.00
9	1	1	3	10.0	1	311.0	9.00	-5.00	99.00	99.00

9 1 1 4 10.0 1 316.0 4.90 -5.60 99.00 99.00  
 9 1 1 5 10.0 1 311.0 4.59 -5.00 99.00 99.00  
 9 1 1 6 10.0 1 300.0 5.22 -5.60 99.00 99.00  
 9 1 1 7 10.0 1 301.0 4.99 -5.60 99.00 99.00  
 9 1 1 8 10.0 1 301.0 4.07 -5.60 99.00 99.00  
 9 1 1 9 10.0 1 305.0 4.83 -4.40 99.00 99.00  
 9 1 1 10 10.0 1 308.0 6.29 -2.80 99.00 99.00  
 9 1 1 11 10.0 1 326.0 6.85 -2.20 99.00 99.00  
 9 1 1 12 10.0 1 323.0 5.17 -1.10 99.00 99.00  
 9 1 1 13 10.0 1 321.0 3.70 -0.60 99.00 99.00  
 9 1 1 14 10.0 1 310.0 3.52 0.00 99.00 99.00  
 9 1 1 15 10.0 1 309.0 1.91 0.60 99.00 99.00  
 9 1 1 16 10.0 1 302.0 1.38 0.60 99.00 99.00  
 9 1 1 17 10.0 1 127.0 1.08 -1.10 99.00 99.00  
 9 1 1 18 10.0 1 124.0 1.89 -2.20 99.00 99.00  
 9 1 1 19 10.0 1 143.0 2.39 -2.80 99.00 99.00  
 9 1 1 20 10.0 1 148.0 2.50 -3.90 99.00 99.00  
 9 1 1 21 10.0 1 154.0 2.67 -3.30 99.00 99.00  
 9 1 1 22 10.0 1 163.0 3.13 -2.80 99.00 99.00  
 9 1 1 23 10.0 1 161.0 3.39 -2.20 99.00 99.00  
 9 1 1 24 10.0 1 171.0 4.68 -1.70 99.00 99.00  
 9 1 2 1 10.0 1 174.0 4.17 -1.10 99.00 99.00

<File not complete>

**AERMOD SFC File: [Surface air met data file]**

**a. Sample file 1 – For jurisdictions using DCA airport met data as assigned in Appendix I2:**

38.847N 77.035W UA\_ID: 93734 SF\_ID: 13743 OS\_ID: VERSION:14134 THRESH\_1MIN= 0.50  
 m/s; CCVR\_Sub TEMP\_Sub  
 9 1 1 1 1 -52.2 0.436 -9.000 -9.000 -999. 692. 145.0 0.0420 0.74 1.00 6.35 314.0 10.0 268.8 2.0 0  
 0.00 41. 1020. 0 ADJ-A1  
 9 1 1 1 2 -49.4 0.432 -9.000 -9.000 -999. 682. 149.0 0.0420 0.74 1.00 6.28 315.0 10.0 268.8 2.0 0  
 0.00 41. 1021. 3 ADJ-A1  
 9 1 1 1 3 -49.1 0.410 -9.000 -9.000 -999. 630. 127.8 0.0420 0.74 1.00 6.01 306.0 10.0 268.8 2.0 0  
 0.00 41. 1022. 0 ADJ-A1  
 9 1 1 1 4 -51.7 0.432 -9.000 -9.000 -999. 680. 141.9 0.0420 0.74 1.00 6.29 301.0 10.0 268.8 2.0 0  
 0.00 41. 1023. 0 ADJ-A1  
 9 1 1 1 5 -47.6 0.397 -9.000 -9.000 -999. 602. 120.1 0.0420 0.74 1.00 5.85 305.0 10.0 268.8 2.0 0  
 0.00 43. 1024. 0 ADJ-A1  
 9 1 1 1 6 -44.1 0.368 -9.000 -9.000 -999. 536. 102.9 0.0420 0.74 1.00 5.48 306.0 10.0 268.8 2.0 0  
 0.00 45. 1024. 0 ADJ-A1  
 9 1 1 1 7 -38.2 0.333 -9.000 -9.000 -999. 462. 88.4 0.0420 0.74 1.00 5.03 313.0 10.0 268.8 2.0 0  
 0.00 45. 1025. 3 ADJ-A1  
 9 1 1 1 8 -27.1 0.236 -9.000 -9.000 -999. 280. 44.5 0.0420 0.74 1.00 3.90 308.0 10.0 268.8 2.0 0  
 0.00 47. 1026. 3 ADJ-A1  
 9 1 1 1 9 -1.3 0.326 -9.000 -9.000 -999. 447. 2470.6 0.0420 0.74 0.40 4.48 319.0 10.0 269.9 2.0 0  
 0.00 46. 1027. 3 ADJ-A1  
 9 1 1 1 10 38.7 0.404 0.826 0.005 535. 616. -156.4 0.0420 0.74 0.27 5.33 315.0 10.0 270.9 2.0 0  
 0.00 42. 1028. 3 ADJ-A1

9 1 1 111 67.7 0.468 1.280 0.018 1135. 767. -138.3 0.0250 0.74 0.22 6.75 331.0 10.0 272.0 2.0  
 0 0.00 39. 1027. 5 ADJ-A1  
 9 1 1 112 84.0 0.375 1.381 0.017 1150. 557. -57.3 0.0250 0.74 0.20 5.22 330.0 10.0 272.0 2.0 0  
 0.00 37. 1026. 5 ADJ-A1  
 9 1 1 113 86.7 0.293 1.403 0.017 1165. 385. -26.6 0.0250 0.74 0.20 3.90 326.0 10.0 273.8 2.0 0  
 0.00 36. 1026. 5 ADJ-A1  
 9 1 1 114 75.7 0.290 1.345 0.016 1178. 376. -29.6 0.0420 0.74 0.21 3.52 318.0 10.0 273.8 2.0 0  
 0.00 33. 1026. 5 ADJ-A1  
 9 1 1 115 23.7 0.103 0.916 0.016 1182. 121. -4.3 0.0030 0.74 0.24 1.69 82.0 10.0 273.8 2.0 0  
 0.00 33. 1025. 9 ADJ-A1  
 9 1 1 116 16.7 0.118 0.815 0.016 1185. 98. -9.1 0.0030 0.74 0.33 2.06 65.0 10.0 274.2 2.0 0  
 0.00 31. 1025. 5 ADJ-A1  
 9 1 1 117 -3.3 0.057 -9.000 -9.000 -999. 34. 5.3 0.0220 0.74 0.58 1.76 221.0 10.0 273.1 2.0 0  
 0.00 33. 1025. 5 ADJ-SFC  
 9 1 1 118 -3.7 0.057 -9.000 -9.000 -999. 33. 4.7 0.0220 0.74 1.00 1.76 197.0 10.0 272.5 2.0 0  
 0.00 34. 1025. 3 ADJ-SFC  
 9 1 1 119 -4.4 0.058 -9.000 -9.000 -999. 34. 4.1 0.0030 0.74 1.00 2.36 184.0 10.0 271.4 2.0 0  
 0.00 50. 1024. 3 ADJ-SFC  
 9 1 1 120 -19.8 0.167 -9.000 -9.000 -999. 163. 21.4 0.0030 0.74 1.00 4.36 177.0 10.0 271.4 2.0 0  
 0.00 46. 1024. 0 ADJ-SFC  
 9 1 1 121 -6.2 0.070 -9.000 -9.000 -999. 50. 5.2 0.0030 0.74 1.00 2.86 170.0 10.0 270.9 2.0 0  
 0.00 50. 1023. 5 ADJ-SFC  
 9 1 1 122 -23.8 0.211 -9.000 -9.000 -999. 232. 35.7 0.0030 0.74 1.00 5.01 169.0 10.0 271.4 2.0 0  
 0.00 48. 1022. 3 ADJ-A1  
 9 1 1 123 -16.1 0.228 -9.000 -9.000 -999. 261. 67.1 0.0030 0.74 1.00 5.05 173.0 10.0 271.4 2.0 0  
 0.00 53. 1021. 9 ADJ-A1  
 9 1 1 124 -19.8 0.281 -9.000 -9.000 -999. 357. 101.8 0.0030 0.74 1.00 6.04 181.0 10.0 271.4 2.0  
 0 0.00 53. 1020. 9 ADJ-A1  
 9 1 2 2 1 -18.4 0.312 -9.000 -9.000 -999. 419. 150.3 0.0220 0.74 1.00 5.04 194.0 10.0 272.0 2.0 0  
 0.00 42. 1020. 10 ADJ-A1  
 <File not complete>

**b. Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I2:**

38.934N 77.447W UA\_ID: 93734 SF\_ID: 93738 OS\_ID: VERSION:14134 THRESH\_1MIN= 0.50  
 m/s; CCVR\_Sub TEMP\_Sub  
 9 1 1 1 1 -39.8 0.384 -9.000 -9.000 -999. 572. 128.5 0.0210 0.93 1.00 6.30 317.0 10.0 268.8 2.0 0  
 0.00 45. 1011. 5 ADJ-A1  
 9 1 1 1 2 -47.9 0.461 -9.000 -9.000 -999. 751. 184.4 0.0210 0.93 1.00 7.42 321.0 10.0 268.1 2.0 0  
 0.00 49. 1011. 5 ADJ-A1  
 9 1 1 1 3 -64.0 0.566 -9.000 -9.000 -999. 1020. 255.4 0.0210 0.93 1.00 9.00 311.0 10.0 268.1 2.0  
 0 0.00 47. 1012. 3 ADJ-A1  
 9 1 1 1 4 -32.0 0.281 -9.000 -9.000 -999. 449. 62.8 0.0210 0.93 1.00 4.90 316.0 10.0 267.5 2.0 0  
 0.00 52. 1013. 3 ADJ-A1  
 9 1 1 1 5 -29.3 0.258 -9.000 -9.000 -999. 317. 53.0 0.0210 0.93 1.00 4.59 311.0 10.0 268.1 2.0 0  
 0.00 49. 1014. 3 ADJ-A1  
 9 1 1 1 6 -34.8 0.305 -9.000 -9.000 -999. 404. 73.8 0.0210 0.93 1.00 5.22 300.0 10.0 267.5 2.0 0  
 0.00 54. 1015. 3 ADJ-A1

9 1 1 1 7 -34.2 0.286 -9.000-9.000-999. 368. 62.1 0.0210 0.93 1.00 4.99 301.0 10.0 267.5 2.0 0  
 0.00 52. 1016. 0 ADJ-A1  
 9 1 1 1 8 -25.6 0.214 -9.000-9.000-999. 239. 34.7 0.0210 0.93 1.00 4.07 301.0 10.0 267.5 2.0 0  
 0.00 52. 1016. 0 ADJ-A1  
 9 1 1 1 9 -4.3 0.309 -9.000-9.000 -999. 413. 627.3 0.0210 0.93 0.41 4.83 305.0 10.0 268.8 2.0 0  
 0.00 47. 1017. 3 ADJ-A1  
 9 1 1 1 10 41.3 0.421 0.861 0.005 560. 655. -163.8 0.0210 0.93 0.28 6.29 308.0 10.0 270.4 2.0 0  
 0.00 42. 1018. 3 ADJ-A1  
 9 1 1 1 11 35.0 0.454 0.944 0.013 873. 735. -243.4 0.0210 0.93 0.23 6.85 326.0 10.0 270.9 2.0 0  
 0.00 40. 1018. 9 ADJ-A1  
 9 1 1 1 12 44.6 0.353 1.118 0.018 1138. 510. -89.4 0.0210 0.93 0.21 5.17 323.0 10.0 272.0 2.0 0  
 0.00 37. 1017. 9 ADJ-A1  
 9 1 1 1 13 66.6 0.269 1.283 0.017 1150. 339. -26.6 0.0210 0.93 0.21 3.70 321.0 10.0 272.5 2.0 0  
 0.00 36. 1016. 8 ADJ-A1  
 9 1 1 1 14 40.2 0.251 1.087 0.017 1157. 303. -35.7 0.0210 0.93 0.22 3.52 310.0 10.0 273.1 2.0 0  
 0.00 34. 1015. 9 ADJ-A1  
 9 1 1 1 15 26.6 0.149 0.949 0.017 1162. 143. -11.3 0.0210 0.93 0.25 1.91 309.0 10.0 273.8 2.0 0  
 0.00 31. 1015. 9 ADJ-A1  
 9 1 1 1 16 19.1 0.113 0.850 0.017 1165. 92. -6.9 0.0210 0.93 0.34 1.38 302.0 10.0 273.8 2.0 0  
 0.00 31. 1015. 5 ADJ-A1  
 9 1 1 1 17 -1.2 0.036 -9.000-9.000-999. 21. 3.3 0.0240 0.93 0.58 1.08 127.0 10.0 272.0 2.0 0  
 0.00 37. 1015. 5 ADJ-A1  
 9 1 1 1 18 -4.2 0.063 -9.000-9.000-999. 38. 5.3 0.0240 0.93 1.00 1.89 124.0 10.0 270.9 2.0 0  
 0.00 42. 1014. 5 ADJ-A1  
 9 1 1 1 19 -6.7 0.079 -9.000-9.000-999. 53. 6.7 0.0240 0.93 1.00 2.39 143.0 10.0 270.4 2.0 0  
 0.00 44. 1014. 5 ADJ-A1  
 9 1 1 1 20 -7.3 0.083 -9.000-9.000-999. 57. 7.0 0.0240 0.93 1.00 2.50 148.0 10.0 269.2 2.0 0  
 0.00 50. 1013. 5 ADJ-A1  
 9 1 1 1 21 -8.9 0.088 -9.000-9.000-999. 63. 7.0 0.0240 0.93 1.00 2.67 154.0 10.0 269.9 2.0 0  
 0.00 50. 1013. 0 ADJ-A1  
 9 1 1 1 22 -14.4 0.139 -9.000-9.000 -999. 125. 17.0 0.0240 0.93 1.00 3.13 163.0 10.0 270.4 2.0 0  
 0.00 46. 1012. 5 ADJ-A1  
 9 1 1 1 23 -13.3 0.191 -9.000-9.000 -999. 200. 47.0 0.0240 0.93 1.00 3.39 161.0 10.0 270.9 2.0 0  
 0.00 46. 1010. 9 ADJ-A1  
 9 1 1 1 24 -17.1 0.292 -9.000-9.000 -999. 378. 130.8 0.0240 0.93 1.00 4.68 171.0 10.0 271.4 2.0  
 0 0.00 41. 1009. 10 ADJ-A1  
 9 1 2 2 1 -14.9 0.255 -9.000-9.000 -999. 310. 100.4 0.0240 0.93 1.00 4.17 174.0 10.0 272.0 2.0 0  
 0.00 37. 1009. 10 ADJ-A1  
 <File not complete>

**AERMOD Receptors File:**

RE STARTING  
 RE ELEVUNIT METERS  
 RE DISCCART 984382 491648  
 RE DISCCART 984395 491616  
 RE DISCCART 984395 491629  
 RE DISCCART 984395 491642  
 RE DISCCART 984395 491655

RE DISCCART 984395 491668  
RE DISCCART 984395 491681  
RE DISCCART 984395 491694  
RE DISCCART 984408 491583  
RE DISCCART 984408 491596  
RE DISCCART 984408 491609  
RE DISCCART 984408 491622  
RE DISCCART 984408 491635  
RE DISCCART 984408 491648  
RE DISCCART 984408 491661  
RE DISCCART 984408 491674  
RE DISCCART 984408 491687  
RE DISCCART 984408 491700  
RE DISCCART 984421 491564  
RE DISCCART 984421 491577  
<File not complete>

# Project-Level Air Quality Analysis Resource Document

## APPENDIX K: EXAMPLE MITIGATION MEASURES

K1: CO Mitigation Measures

K2: PM<sub>2.5</sub> Mitigation Measures

## APPENDIX K1: EXAMPLE CO MITIGATION MEASURES (Related to Transportation Improvements)

- Signal coordination and timing
- Improved intersection channelization
- Inclusion of intersection turning lanes
- Expansion of roadway by adding through lanes if traffic volume increases do not offset impacts due to improved speeds
- Other site design measures that reduce the impacts of proximate CO through improved dispersion
- Traffic circulation changes that would re-route traffic around locations of high concentrations
- Travel demand management strategies
- Bike and pedestrian improvements
- Improved or additional transit service

## APPENDIX K2: EXAMPLE PM<sub>2.5</sub> MITIGATION MEASURES

(Related to Transportation Improvements)

Per Section 10 of EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM<sub>2.5</sub> and PM<sub>10</sub> Nonattainment and Maintenance Areas* (EPA-420-B-15-084)

### **Retrofitting, replacing vehicles/engines, and using cleaner fuels**

- The installation of retrofit devices on older, higher emitting vehicles is one way to reduce emissions. Retrofit devices such as Diesel Particulate Filters (DPFs) or Diesel Oxidation Catalysts (DOCs) can be installed on diesel truck or bus fleets, and off-road construction equipment when applicable to lower emissions cost effectively.
- Replacing older engines with newer, cleaner engines, including engines powered by compressed natural gas (CNG), liquefied natural gas (LNG), biodiesel, or electricity is another way to reduce emissions from existing diesel truck or bus fleets. Many engines can also benefit from being rebuilt, repaired, upgraded to a more recent standard, and properly maintained. The emission reduction calculations should take into account whether retired vehicles or engines are permanently scrapped.
- The accelerated retirement or replacement of older heavy-duty diesel vehicles with cleaner vehicles is another way to reduce emissions. A replacement program could apply to buses, trucks, or construction equipment.<sup>164</sup> In some areas, local regulations to ban older trucks at specific port facilities have encouraged early replacement of vehicles. Such an option would need to be discussed with the local government with implementing authority.
  - For additional information about quantifying the benefits of retrofitting and replacing diesel vehicles and engines for conformity determinations, see EPA's website for the most recent guidance on this topic:  
[www.epa.gov/otaq/stateresources/transconf/policy.htm](http://www.epa.gov/otaq/stateresources/transconf/policy.htm).
  - Also see EPA's National Clean Diesel Campaign website, which includes information about retrofitting vehicles, including lists of EPA-verified retrofit technologies and certified technologies; clean fuels; grants; case studies; toolkits; and partnership programs:  
<http://www.epa.gov/cleandiesel>

### **Reduced idling programs**

- Anti-idling programs for diesel trucks or buses may be relevant for projects where significant numbers of diesel vehicles are congregating for extended periods of time (e.g., restrictions on long duration truck idling, truck stop electrification, or time limits on bus idling at a terminal).
  - A list of EPA-verified anti-idle technologies for trucks can be found at:  
<http://epa.gov/smartway/forpartners/technology.htm>

### **Transportation project design revisions**

- For transit and other terminals, project sponsors could consider redesigning the project to reduce the number of diesel vehicles congregating at any one location. Terminal operators

can also take steps to improve gate operations to reduce vehicle idling inside and outside the facility. Fewer diesel vehicles congregating could reduce localized PM<sub>2.5</sub> or PM<sub>10</sub> emissions for transit and other terminal projects.

- A list of strategies to reduce emissions from trucks operating at marine and rail terminals are available at:

<http://www3.epa.gov/smartway/forpartners/technology.htm>

- It may be possible in some cases to route existing or projected traffic away from populated areas to an industrial setting (e.g., truck only lanes). Project sponsors should take into account any changes in travel activity, including additional VMT, that would result from rerouting this traffic. Note that this option may also change the air quality modeling receptors that are examined in the PM hot-spot analysis.
- Finally, project sponsors could consider additional modes for travel and goods movement. An example would be transporting freight by cleaner rail instead of by highway (e.g., putting port freight on electric trains instead of transporting it by truck).

#### **Fugitive dust control programs**

Fugitive dust control programs will primarily be applicable in PM<sub>10</sub> hot-spot analyses, since all PM<sub>10</sub> nonattainment and maintenance areas must include these emissions in such analyses. However, there may be PM<sub>2.5</sub> nonattainment and maintenance areas that also could take advantage of these measures if re-entrained road dust or construction dust is required for a PM<sub>2.5</sub> hot-spot analysis. See Section 2.5 for further background.

- A project sponsor could commit to cover any open trucks used in construction of the project if construction emissions are included in an analysis year. Some states have laws requiring that open truck containers be covered to reduce dispersion of material. Laws may differ in terms of requirements, e.g., some require covering at all times, some require covering in limited circumstances, and some restrict spillage.
- A project sponsor could employ or obtain a commitment from another local agency to implement a street cleaning program. There is a variety of equipment available for this purpose and such programs could include vacuuming or flushing techniques. There have been circumstances where municipalities have implemented street sweeping programs for air quality purposes.
- Another option to reduce dust could be a site-watering program, which may be relevant during the construction phase of a project, if construction emissions are included in the PM hot-spot analysis.
- Project sponsors may consider street and shoulder paving and runoff and erosion control in the project area, which can reduce significant quantities of dust.
- It may also be possible to reduce the use of sand in snow and ice control programs, to apply additional chemical treatments, or to use harder material (that is less likely to grind into finer particles).

#### **Addressing other source emissions**

Note: Controlling emissions from other sources may sufficiently reduce background concentrations in the PM hot-spot analysis.

- Reducing emissions from school buses may be relevant where such emissions are part of background concentrations. Information about retrofitting, replacing, and reducing idling of school buses can be found on EPA’s website at: <http://www.epa.gov/cleandiesel/clean-school-bus>.
- Reducing emissions from ships, cargo handling equipment and other vehicles at ports may change the result of the PM hot-spot analysis. Options such as retrofitting, repowering, or replacing engines or vehicles, use of cleaner fuels, or “cold ironing” (that allows ships to plug in to shore-side power units) could be relevant where these sources significantly influence background concentrations in the project area. More information about reducing emissions at ports can be found on EPA’s website at: <http://www.epa.gov/ports-initiative>
- Adopting locomotive anti-idling policies or other measures. For additional information, see the following EPA resources:
  - “Guidance for Quantifying and Using Long Duration Switch Yard Locomotive Idling Emission Reductions in State Implementation Plans,” EPA420-B-04-09-037 (October 2009) available at: [www.epa.gov/otaq/diesel/documents/420b09037.pdf](http://www.epa.gov/otaq/diesel/documents/420b09037.pdf)
  - EPA-verified anti-idle technologies for locomotives can be found at: <http://www3.epa.gov/smartway/forpartners/technology.htm>
- Remanufacturing existing locomotives to meet more stringent standards at a rate faster than the historical average, or using only Tier 3 and/or Tier 4 locomotives at a proposed terminal (once such locomotives become available).
- Reducing emissions from a stationary source might also change the result of the PM hot-spot analysis. Reductions could come from adding a control technology to a stationary source or adopting policies to reduce peak emissions at such a source. EPA and the state and/or local air quality agency could provide input on the feasibility and implementation of such a measure, as well as any necessary commitments to such measures from operators.

#### **Other Mitigation Strategies**

Additional mitigation measures include delaying the project build year, restrictions to heavy-duty diesel traffic, restricting speed limits to an emission-optimized level, dedicated truck lanes, and creating a buffer zone between the roadway and nearby receptors. For additional information see Chapter 4 of the published CalTrans guide: *Bai S., Craig K., Graham A., Reid S., Eisinger D., Farstad E., Erdakos G., Du Y., and Baringer L. (2015) “Quantitative Particulate Matter Hot-Spot Analysis Best Practices Guidebook”, prepared for the California Department of Transportation, Sacramento, CA, CTAQ-RT-15-317.02.3, Version 1.1, November 30.*

# Project-Level Air Quality Analysis Resource Document

## APPENDIX L: VDOT PM<sub>2.5</sub> PROJECT ASSESSMENT CRITERIA

**PM<sub>2.5</sub> Project Assessment Criteria by Project Type<sup>32</sup>**

➤ **All Projects**

Any project of a type identified in EPA guidance as one that would not be of air quality concern would be cleared.

➤ **New Highway Construction\***

Is the opening year diesel annual average daily truck traffic (AADTT)** less than or equal to <b>10,000***</b> ?	
<b>Yes</b>	<b>No</b>
Clearly Not A Project of Air Quality Concern	Additional Review Required

\* Any associated interchanges will be assessed based on mainline highway diesel AADTT.

\*\* As defined by FHWA’s Class 4-13 vehicle types per FHWA’s Traffic Monitoring Guide, Appendix C (<https://www.fhwa.dot.gov/policyinformation/tmguide/>). Diesel trucks are a subset of the total truck numbers. In the absence of diesel percentages, total truck volumes may be used since these are most likely the values provided by traffic studies and serve as a more conservative estimate of potential PM emissions.

\*\*\*This value is based on the example presented in EPA guidance first in 2006 and carried forward in the most recent (2013) update, namely<sup>33</sup>: “A project on a new highway or expressway that serves a significant volume of diesel truck traffic, such as facilities with greater than 125,000 annual average daily traffic (AADT) and 8% or more of such AADT is diesel truck traffic.”

<sup>32</sup> See 40 CFR 93.123 for procedures for determining localized CO, PM10, and PM2.5 concentrations (hot-spot analysis) <http://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol21/xml/CFR-2013-title40-vol21-sec93-123.xml>.  
<sup>33</sup> See Appendix B of: EPA, *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas*, EPA-420-B-13-053, November 2013

➤ **Highway Capacity Expansion\***

Is the <u>increase</u> in diesel AADTT (if any) for the opening year build scenario less than or equal to <b>20%</b> of the criteria listed above for New Highway Construction?		
<b>Yes</b>	<b>No</b>	
<b>Clearly Not A Project of Air Quality Concern</b>	Is the opening year diesel AADTT at or below the criteria listed above for New Highway Construction?	
	<b>Yes</b>	<b>No</b>
	<b>Clearly Not a Project of Air Quality Concern</b>	<b>Additional Review Required</b>

\* Any associated interchanges will be assessed based on mainline highway diesel AADTT.

➤ **Intersections**

Is the project expected to either improve the Level-of-Service (LOS) for intersections operating at D, E or F with significant diesel AADTT or, if there is a significant increase in diesel AADTT related to the project, not degrade intersection LOS to D, E or F?		
<b>Yes</b>	<b>No</b>	
<b>Clearly Not A Project of Air Quality Concern</b>	Is the opening year diesel AADTT at or below the criteria listed above for New Highway Construction or, is the increase in diesel AADTT (if any) less than or equal to the criteria specified above for Highway Capacity Expansion?	
	<b>Yes</b>	<b>No</b>
	<b>Clearly Not a Project of Air Quality Concern</b>	<b>Additional Review Required</b>

➤ **New Intermodal or Transit Facility for Rail, Bus, or Truck**

Is the facility not considered to be a “regionally significant project” under 40 CFR 93.101*?	
<b>Yes</b>	<b>No</b>
<b>Clearly Not A Project of Air Quality Concern</b>	<b>Additional Review Required</b>

*\*This criterion is based on the example of projects of air quality concern presented in EPA guidance<sup>34</sup>: “A major new bus or intermodal terminal that is considered to be a “regionally significant project” under 40 CFR 93.101.”*

➤ **Expanded Intermodal or Transit Facility for Rail, Bus, or Truck**

Will the expanded facility have less than a <b>50% increase</b> in daily diesel bus/truck arrivals or, for small facilities, a total of less than or equal to <b>15</b> diesel buses/trucks in the peak hour of that facility*?		
<b>Yes</b>	<b>No</b>	
<b>Clearly Not A Project of Air Quality Concern</b>	Does the expanded facility otherwise meet the criteria specified for New Intermodal or Transit Facilities as specified above?	
	<b>Yes</b>	<b>No</b>
	<b>Clearly Not a Project of Air Quality Concern</b>	<b>Additional Review Required</b>

*\*These values are based on the examples presented in EPA guidance<sup>35</sup>:*

- *Of air quality concern: “An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by bus arrivals”*
- *Not of air quality concern: “A 50% increase in daily arrivals at a small terminal (e.g., a facility with 10 buses in the peak hour).”*

<sup>34</sup> *Ibid.*

<sup>35</sup> *Ibid.*