PROJECT-LEVEL AIR QUALITY ANALYSIS RESOURCE DOCUMENT

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1. INTRODUCTION

1.1 ROLE AND COVERAGE

This Resource Document[1,2] 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 in Virginia at present are conducted to support environmental clearance documents being prepared for purposes of the National Environmental Policy Act (NEPA), and developed following guidance provided by the US Department of Transportation (US DOT). No areas at present are subject to the additional and more detailed project-level analysis (“hot-spot”) requirements of the federal transportation conformity rule (40 CFR Parts 51 and 93) issued by the US Environmental Protection Agency (US EPA) for either carbon monoxide (CO) or fine particulate matter (that under 2.5 microns in diameter, or $PM_{2.5}$).[3]

Regional conformity requirements apply for the Washington, DC-MD-VA region, which is currently in nonattainment for ozone[4]. Three other regions (Fredericksburg, Richmond/Tri-Cities and Hampton

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

2 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.

3 For reference in cases where previous project-level air quality analyses are being updated that did include a conformity analysis for CO and/or $PM_{2.5}$, the updated analysis is not subject to conformity requirements and therefore does not require an updated conformity analysis for either pollutant.

- For CO, Arlington County and the City of Alexandria in northern Virginia were in maintenance until the second ten-year maintenance period expired on March 16, 2016, at which point conformity requirements for CO terminated. Note a CO analysis update may still be done for NEPA but is not required to meet the more detailed EPA conformity requirements.
- For $PM_{2.5}$, EPA revoked the applicable (1997 annual primary) national ambient air quality standard (NAAQS) in a Final Rule published in the Federal Register on August 24, 2016 (effective October 24, 2016), which eliminated the associated conformity requirements. Until then, project-level conformity requirements applied for the following jurisdictions in Virginia as listed on the US EPA Green Book web page (https://www.epa.gov/green-book) for the DC-MD-VA maintenance area: Alexandria, Arlington County, Fairfax, Fairfax County, Falls Church, Loudoun County, Manassas, Manassas Park, and Prince William County.

4 As of the date of preparation of this update, a redesignation request from nonattainment to maintenance has been submitted to EPA. See: https://www.mwcog.org/documents/2017/09/18/washington-dc-md-va-

Roads) are also subject to regional conformity requirements for ozone[5], although they are all currently in attainment for all of the national ambient air quality standards (NAAQS) established by EPA.

References and links to key regulations and guidance documents for both NEPA and conformity are provided in **Appendix B-1**.

1.2 CONSULTATION ON RESOURCE DOCUMENT

Inter-agency consultation for conformity purposes (IACC) on the 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)), which was reflected in the corresponding Virginia regulation (9 VAC 5-151 Section 70), and is additional to the inter-agency consultation (IAC) conducted for purposes of NEPA. IACC was conducted in 2015 on the models, methods and assumptions presented or identified in this Resource Document (including the associated online data repository) for the areas or jurisdictions that were then subject to conformity requirements for project-level (hot-spot) analyses for CO and $PM_{2.5}$. 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 to be applied in an analysis. Although IACC is no longer required for CO or $PM_{2.5}$, it is still helpful for purposes of transparency to document that it was done with the NEPA documentation for each project-level analysis. Therefore, the text in Exhibit 1.2.1 (or a similar statement as appropriate to the analysis) should be included in the documentation for each project-level air quality analysis conducted by or on behalf of the Department.

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.

2008-ozone-naaqs-marginal-nonattainment-area--redesignation-request-and-maintenance-plan-air-quality-air-quality-conformity-ozone/

5 Per a 2/16/2018 court decision (South Coast Air Quality Management District v. EPA, or "South Coast II"), all areas in the country that were in nonattainment or maintenance for the 1997 eight-hour ozone NAAQS were again made subject to conformity for that standard, notwithstanding its revocation by EPA in 2015. This decision in part affects "orphan areas" (as defined in the ruling), which in Virginia include Fredericksburg, Richmond/Tri-Cities, and Hampton Roads. The court ruling may be viewed at this link.

In November 2018, EPA issued "Transportation Conformity Guidance for the South Coast II Court Decision" (EPA-420-B-18-050), which may be viewed at this link. While the guidance eliminated the need for regional emission analyses for orphan areas affected by that ruling (p.11), it maintained certain requirements for project-level analyses for these areas, namely (p.13): "Consultation requirements (40 CFR 93.112)"; "There is a currently conforming transportation plan and TIP in place (40 CFR 93.114)"; and "The project is from that transportation plan and TIP (40 CFR 93.115)."

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).[6]

Exhibit 1.2.1 Standard IACC/IAC Reference Text for Project-Level Documentation

For projects located in northern Virginia:

All models, methods, assumptions and protocols specified or referenced within the VDOT Resource Document (see footnote) for projects in northern Virginia were subjected to inter-agency consultation for conformity (IACC) and NEPA (IAC) with FHWA, EPA, DEQ and other agencies prior to being finalized in 2016. IACC was required at that time as it was before project-level conformity requirements in northern Virginia were eliminated for CO (with the expiry of the CO maintenance plan on March 16, 2016) and $PM_{2.5}$ (with the revocation by EPA of the applicable annual primary NAAQS effective October 24, 2016). Appendix A of the Resource Document provides a summary of the consultation process and results. Currently, inter-agency consultation is limited to that needed for purposes of NEPA.

For projects located outside of northern Virginia:

All models, methods, assumptions and protocols specified or referenced within the VDOT Resource Document (see footnote) were subjected to inter-agency consultation with FHWA, DEQ and other agencies for purposes of NEPA prior to being finalized in 2016. Appendix A of the Resource Document provides a summary of the consultation process and results.

Footnote: See: http://www.virginiadot.org/projects/environmental_air_section.asp

6 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).

Exhibit 1.2.2 Standard Text for Additional IAC

For this analysis, and notwithstanding the IACC already conducted on the Resource Document as referenced above and that conformity requirements for project-level analyses no longer apply in Virginia in the absence of a nonattainment or maintenance area for CO or PM, project-specific inter-agency consultation for purposes of NEPA was conducted on <dates> involving the same agency stakeholders as noted above <or list agency stakeholders>. The additional consultation was conducted:

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

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. 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 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 on 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, 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,

   <u>and</u>

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.

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:

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).

2.5.3.3.3 Affected Facilities

The determination of which facilities (if any) are to be considered affected by the proposed improvements is first limited to the affected area identified in a traffic impact or similar analysis (if one is available) conducted for NEPA purposes for the project. With that limitation, the affected facilities to be specified for the air quality analysis are typically identified 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.

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 high level of confidence that the NAAQS will not be exceeded. Such analyses meet all applicable regulatory requirements and maintain consistency, as appropriate, with guidance.

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. The use of worst-case modeling assumptions may be reduced or eliminated in these cases.

2.5.6 Interface and Utility Software

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 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 to be 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*[7]. 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[8]. 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 <u>not</u> 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.

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.

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7 *Highway Capacity Manual 2010 (HCM2010) fifth edition*, Chapter 9 (pages 9-11)

8 AASHTO, "*A Policy on Geometric Design of Highways and Streets",* 2011. See the discussion on roadway grades on pages 235-247.

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

Additional inter-agency consultation 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 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 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 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 would extend to "exceptional-type" events if EPA modifies its 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[9] 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)[10].

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.

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.

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9 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

10 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.

2.8.5.4 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

Project-level conformity requirements for $PM_{2.5}$ do not currently apply in Virginia, as previously noted. If, however, $PM_{2.5}$ conformity requirements were again to become applicable, modeling of any nearby source(s) would generally follow applicable regulations and (as appropriate) guidance. In general, nearby sources for $PM_{2.5}$ are included in air quality modeling only when those sources would be affected by the project[11], and the modeling may further be 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 operational/activity, emission or dispersion modeling inventories or forecasts for nearby stationary sources, including but not limited to 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 to be conducted for any analysis including nearby sources is generally no more than the minimum number of runs that may be specified in 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.

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(s).

[11] Section 8.2, *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*, EPA-420-B-15-084, November 2015.

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 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.

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 also 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

Project-level conformity requirements do not currently apply in Virginia for either CO or $PM_{2.5}$, although they have in the past. The Department may at its discretion follow conformity requirements for CO, in the absence of detailed NEPA procedures. Additionally, if PM2.5 conformity requirements were again to become applicable, the procedures and data specified in this section would be followed.

3.1 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, input data for project-level modeling that are posted to the DR may be obtained from regional conformity inputs prepared by the metropolitan planning organization (MPO) to the extent reasonable and appropriate. This approach reduces the time and cost for preparing inputs and also serves to maintain consistency with regional emission analyses. 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 regional conformity input data are not available, the above inputs 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, general consistency in meteorological data with regional analyses may also be maintained. The data are typically obtained from VDEQ or, 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 as applicable). 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[12]. Consideration as appropriate is given to any clarifications provided by EPA, e.g., on project types that may qualify for an exemption under safety.[13]

Appendix C provides a list of the current 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 (and any associated clarifications from EPA)[14] 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

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12 Projects listed as exempt for conformity purposes are typically also treated as exempt for purposes of NEPA.

13 See Question 6 in "PM Hot-spot Analyses: Frequently Asked Questions", EPA-420-F-18-011, June 2018. Link: https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses#pmguidance Direct link: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100UKQS.pdf

14 *Ibid.*

project purpose and need statement), they typically are documented with the environmental clearance information prepared by or on behalf of the Department.

3.2.2 Categorical Findings

The federal transportation conformity rule at 40 CFR 93.123(a)(3)[15] 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 FHWA, in consultation with EPA, implemented a new categorical finding for CO, which it last updated in 2017[16]. **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. Although conformity no longer applies for CO in Virginia, the categorical finding for CO may be applied as appropriate for projects located in Virginia for purposes of NEPA, consistent with the protocol specified in Section 4.2.3. Future updates to the federal categorical finding for CO as well as any new federal categorical findings may also be applied 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 FHWA to streamline air quality analyses conducted for NEPA purposes are similar in design and documentation to categorical findings developed to meet conformity requirements. FHWA consults with the US EPA in the development of categorical findings and may do the same for 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 (should project-level conformity requirements again become applicable) without requiring inter-agency consultation additional

15 See: https://www.gpo.gov/fdsys/pkg/CFR-2015-title40-vol20/xml/CFR-2015-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.*

16 See: https://www.fhwa.dot.gov/environment/air_quality/conformity/policy_and_guidance/cmcf_2017/index.cfm

to that conducted on this Resource Document, and may be applied at the discretion of the Department (in consultation with FHWA as appropriate):

- Any national, state or regional programmatic agreement(s) or their equivalents designed and/or implemented by FHWA/FTA (which may be done 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 FHWA/FTA (including those based on a federal or national template[17]) 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 $PM_{2.5}$ 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

[17] At the time of preparation of this update to the VDOT Resource Document, only one national template for a programmatic agreement has been developed and implemented: the National Cooperative Highway Research Program (NCHRP) 25-25 Task 78 template programmatic agreement and technical support document for CO. An update (under NCHRP 25-25 Task 104) to the Task 78 has recently been initiated that would expand coverage of project configurations and to use the subsequently updated version of the EPA MOVES model. FHWA has also initiated development of a new programmatic screening option, which is being coordinated with the NCHRP 25-25 Task 104 study; at the date of preparation of this docment, the FHWA study is still in progress.

- NCHRP 25-25 Task 78, "*Programmatic Agreements for Project-Level Air Quality Analyses*", 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.
- NCHRP 25-25 Task 104: "*Streamlining Carbon Monoxide Project-Level Air Quality Analyses with Programmatic Agreements*", (2018 in progress)
  See: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=4100

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.

Data and Information Requirements:

The data and forecasts needed for $PM_{2.5}$ 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 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**.

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 more representative 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 $PM_{2.5}$ QUANTITATIVE HOT-SPOT ANALYSIS

Should $PM_{2.5}$ conformity requirements again become applicable and the project cannot be cleared using the criteria in Appendix L as one not of potential air quality concern, a quantitative analysis may be conducted. The following protocols and resources should be used when conducting a $PM_{2.5}$ project-level air quality analysis.

3.4.1 Applicable Regulations, Guidance and Analysis Protocols

Links to EPA 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.

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**.

Note, based on the most recent revision of the EPA Appendix W Guideline on Air Quality Models, both AERMOD and, for a limited time, CAL3QHCR, may be applied for project-level analyses for PM. CAL3QHCR is being phased out by EPA over a three-year period, after which only AERMOD may be applied[18].

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[19].

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[18] The final rule was published in the Federal Register on January 17, 2017 with an effective date of February 16, 2017, which was later delayed to May 22, 2017.

Federal Register Notices for the Final Rule, and the Subsequent Delay of Effective Dates:
https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0310-0154
https://www.regulations.gov/document?D=EPA-HQ-OAR-2015-0310-0180

For more information, see: *https://www3.epa.gov/ttn/scram/appendix_w-2016.htm*
Excerpt (accessed 4/18/2018):
"Status of CALINE3 Models
The EPA is finalizing replacement of CALINE3 with AERMOD as the preferred appendix A model for refined mobile source applications including fine particle pollution (PM2.5, PM10), and carbon monoxide (CO) hot-spot analyses. The final action is based on the more scientifically sound basis for AERMOD, improved model performance over CALINE3, and the availability of more representative meteorological data. The transition period for the use of AERMOD for these refined modeling applications was extended to 3 years and the use of CAL3QHC for CO screening analyses was retained."

[19] The VDOT Resource Document and associated online data repository are updated periodically and may not have the most recent versions of the meteorological files at the time a specific project-level air quality

- The most recent 5-year SCRAM surface and upper air meteorological data files provided on EPA's website[20]. 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[21].
- 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[22].

Available Resources

- **Appendix G3** lists typical defaults for $PM_{2.5}$ 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[23].

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 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.

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analysis is being initiated. Check with the VDEQ Office of Air Quality Assessments to ensure that you have the most recent versions of the files. See: http://www.deq.virginia.gov/Programs/Air/AirQualityAssessments.aspx
Note VDEQ does not currently produce meteorological input files for the CAL3QHCR dispersion model.

20 See: http://www.epa.gov/ttn/scram/surfacemetdata.htm

21 PCRAMMET: https://www.epa.gov/scram/meteorological-processors-and-accessory-programs

22 See: https://www3.epa.gov/ttn/scram/appendix_w-2016.htm

23 FHWA does not at present have an approved methodology for converting AERMOD meteorological files to the formats needed by CAL3QHCR.

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 for $PM_{2.5}$ are not typically addressed in project-level analyses. If and when the conformity criterion is met, construction-related emissions for $PM_{2.5}$ 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**.

4. RESOURCES FOR NEPA

All areas in Virginia are subject to NEPA only at present, as project-level conformity requirements do not currently apply. The following resources may be applied for NEPA air quality 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

At the discretion of the Department, a project that would be considered exempt under the federal transportation conformity rule may also be considered exempt for purposes of NEPA, even if the project is not located in an area subject to conformity. **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 FHWA, 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. At the discretion of the Department (in consultation with FHWA as appropriate):

- 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/FTA 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 for purposes of either NEPA or conformity. 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 FHWA 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 FHWA 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 generally follow FHWA (not EPA) guidance and the general and NEPA-specific protocols established by the Department[24]. For example,

[24] Per VDOT Scoping Guidelines (Section 2.2), the Department at its discretion may opt to follow the more detailed EPA procedures for CO analyses, e.g., for projects involving an EIS, of greater interest to the public and stakeholders, and/or that are more complex.

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.

4.5 MSAT PROJECT-LEVEL ANALYSES

MSAT 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 their guidance and training materials (and 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., changes in AADT, travel time and intersection delay) 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.

As provided for in the FHWA response to the first question in their FAQs[25] for MSATs and later reflected in NCHRP guidance[26], the identification of affected links for MSATs should be based on traffic studies developed for the project for the NEPA study, which may be a traffic impact assessment, operational analysis, or other type of traffic study. A separate traffic study for purposes of the MSAT analysis is NOT needed. In other words:

- The set of affected links identified in the NEPA traffic study should be the starting point for the MSAT analysis. The FHWA-specified MSAT criteria (changes in AADT etc.)

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[25] FHWA, "Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents", FHWA HEP-15-056, 2016. See:
https://www.fhwa.dot.gov/environment/air_quality/air_toxics/policy_and_guidance/moves_msat_faq.cfm
Excerpt for Question 2:
"Q. 2) How do I define the affected environment?
A. 2) NEPA documentation should focus on the impacts of the proposed project on the affected environment. Traffic analysis normally performed for NEPA (purpose and need, scope, design, etc.) should be the basis of the MSAT analysis and defining the affected environment…"

[26] NCHRP 25-25, Task 96, "Quick Reference Guide for Traffic Modelers for Generating Traffic and Activity Data for Project-Level Air Quality Analyses", 2018. Note this guide was designed as a supplement to NCHRP 765, which provides detailed guidance for developing traffic for project-level planning and design purposes.
QRG: http://apps.trb.org/cmsfeed/TRBNetProjectDisplay.asp?ProjectID=3971
NCHRP 765: http://www.trb.org/Publications/Blurbs/170900.aspx

are then applied to the NEPA set of affected links to determine the subset that would be specified as the MSAT set of affected links for the project, i.e., MSAT affected links are limited to being a subset of the NEPA affected links.

- If a NEPA traffic study is not available on which to base the identification of affected links for MSATs, the FHWA response to the FAQ allows for the MSAT analysis to be limited to the project links only, i.e., those being improved as part of the project, and not including those in the surrounding area in addition.

This approach of basing the identification of affected links on available traffic studies for NEPA serves to greatly streamline the MSAT analysis process, as a separate traffic analysis for purposes of the MSAT assessment is not typically needed. It also effectively eliminates the potential for inconsistencies between traffic analyses conducted for planning, NEPA and air quality purposes, which may occur if a separate traffic study was to be done for MSAT purposes only. For both of these reasons, the approach of using available NEPA traffic studies as the starting point for MSAT analyses is strongly preferred by the Department.

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[27]. 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 federal guidance pertaining to transportation-oriented greenhouse gases, 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[28] for project-level air quality analyses provides 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.

If and when federal guidance pertaining to transportation-oriented greenhouse gases is issued, it will be implemented as appropriate.

[27] See: http://www.virginiadot.org/projects/environmental_air_section.asp

[28] *Ibid.*

APPENDIX A: INTERAGENCY CONSULTATION

A1: IACC Meeting Minutes (including email transmittals)

A2: IACC Meeting Presentation

A3: December 2015 Draft Resource Document
(Sections that were subjected to consultation for conformity)
(Not included here due to length, but 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:

Name	Agency
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:

Name	Agency
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 $PM_{2.5}$ 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 (MWCOG) recommended that Appendix F and other sections, as appropriate, be updated to reflect the optional use of EPA's vehicle age projection tool. MWCOG does not currently use this tool. VDOT agreed to make this change to the Resource Document.

    - Eulalie Lucas (MWCOG) 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 $PM_{2.5}$ project assessment criteria), Dan Szekeres asked if there were any questions or comments on the document contents.

    - Dusan Vuksan (MWCOG) 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 $PM_{2.5}$ 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

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@mwcog.org'; elucas@mwcog.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'; 'lmarcus@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: Szekeres, 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@mwcog.org'; elucas@mwcog.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'; 'lmarcus@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: 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)

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* 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 | www.mbakerintl.com

From: Szekeres, Dan
Sent:Thursday, December 10, 2015 2:54 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@mwcog.org'; elucas@mwcog.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'; 'lmarcus@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: 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:

5

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

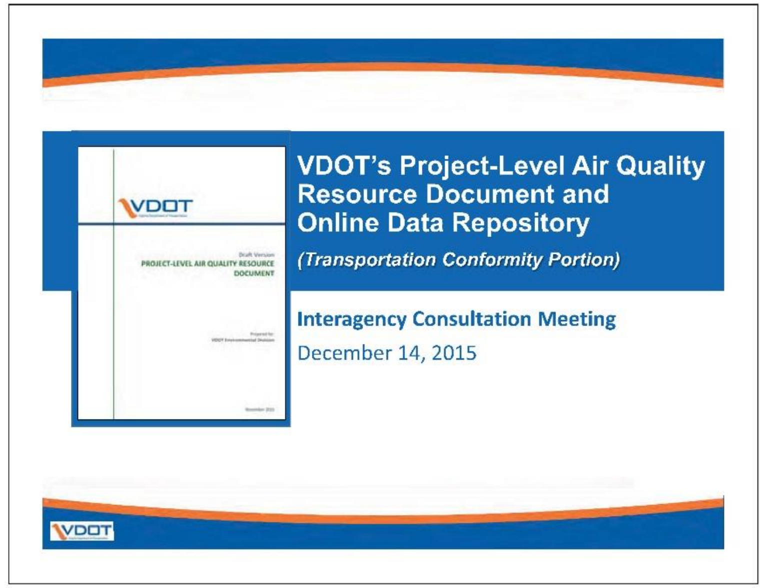
Join by phone
1-855-244-8681 Call-in toll-free number (US/Canada)
1-650-479-3207 Call-in toll number (US/Canada)
Access code: 641 881 658
Global call-in numbers | Toll-free calling restrictions

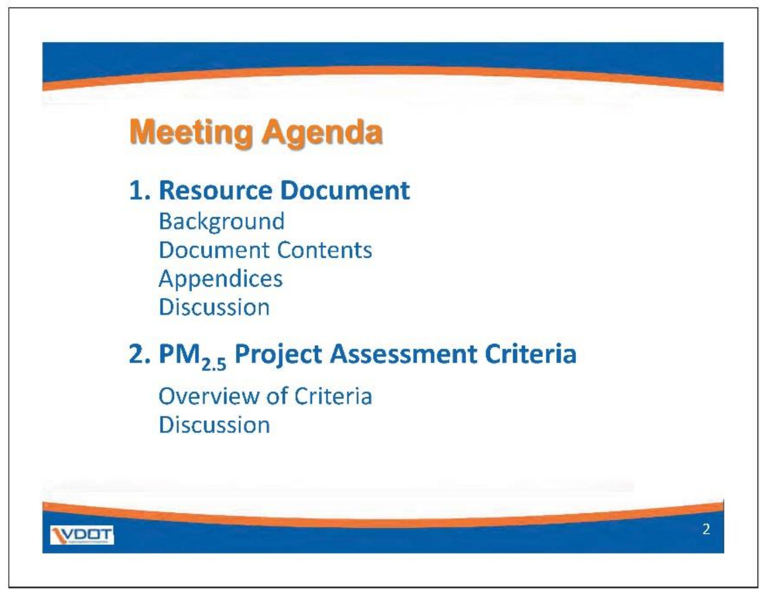
Can't join the meeting? Contact support.
Let us know if you have any problems or questions.

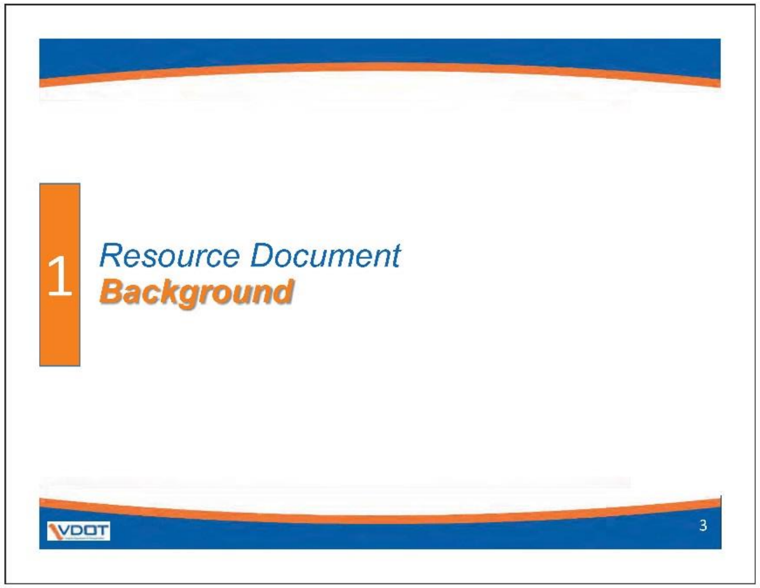
Thanks.

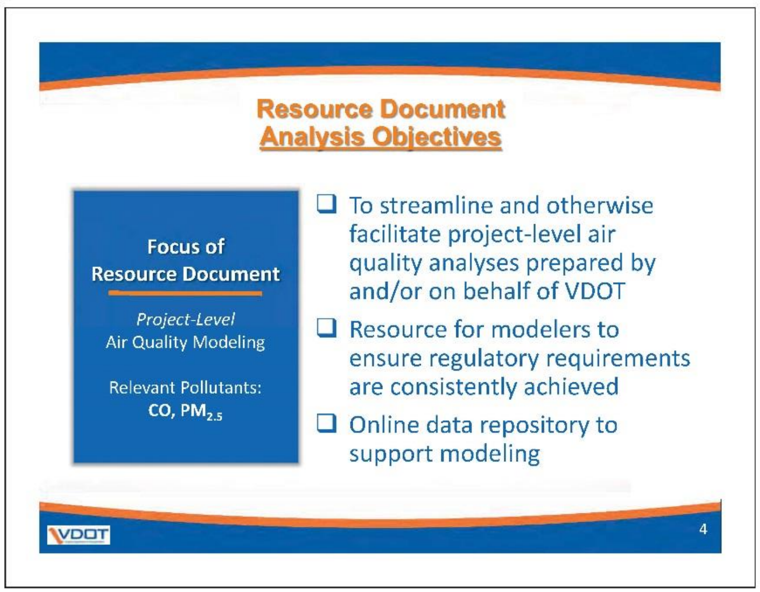
Dan

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


VDOT's Project-Level Air Quality Resource Document and Online Data Repository
(Transportation Conformity Portion)
Interagency Consultation Meeting
December 14, 2015
VDOT
PROJECT-LEVEL AIR QUALITY RESOURCE DOCUMENT


Meeting Agenda
1. Resource Document
Background
Document Contents
Appendices
Discussion
2. $PM_{2.5}$ Project Assessment Criteria
Overview of Criteria
Discussion
VDOT
2


1
Resource Document
Background
VDOT
3


Resource Document
Analysis Objectives
Focus of Resource Document
Project-Level
Air Quality Modeling
Relevant Pollutants:
CO, $PM_{2.5}$
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
VDOT
4

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 **$PM_{2.5}$ project assessment criteria** that limit consultation to those projects that may be of air quality concern

VDOT 5

Federal Regulations (project-level conformity)

- **Conformity Rule - 40 CFR 93.123**
  - Requirements and procedures for determining localized CO, $PM_{2.5}$, and PM_{10} concentrations (hot-spot analysis)
  - Categorical hot-spot finding (currently only for CO)

(40 CFR 93.123c3)

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

VDOT 6

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

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

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

VDOT 9

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."

VDOT 10

Project-Level Conformity Northern Virginia

1997 Annual $PM_{2.5}$

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

Carbon Monoxide (CO)

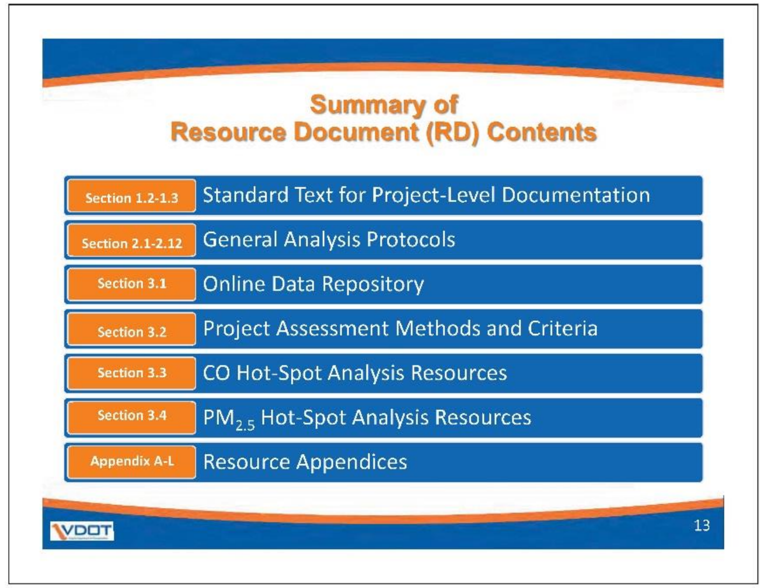
- Alexandria and Arlington County
- **Maintenance status expires 3/22/2016**

Arlington County*
Fairfax County
Loudoun County
Prince William County
City of Alexandria*
City of Fairfax
City of Falls Church
City of Manassas
City of Manassas Park

VDOT 11

Resource Document
Document Contents

VDOT 12


Summary of
Resource Document (RD) Contents
Section 1.2-1.3 Standard Text for Project-Level Documentation
Section 2.1-2.12 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 $PM_{2.5}$ Hot-Spot Analysis Resources
Appendix A-L Resource Appendices
VDOT
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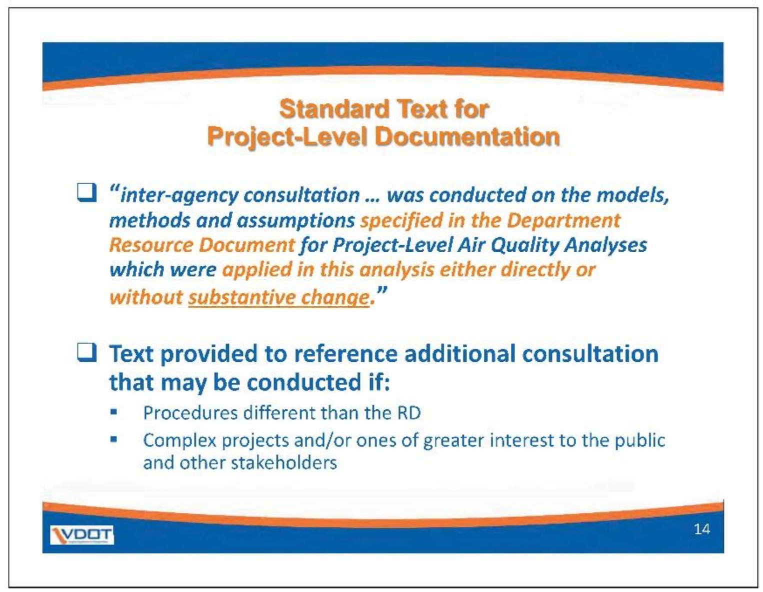
Standard Text for
Project-Level Documentation
"inter-agency consultation … was conducted on the models, methods and assumptions specified in the Department Resource Document for Project-Level Air Quality Analyses which were applied in this analysis either directly or without substantive change."
Text 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
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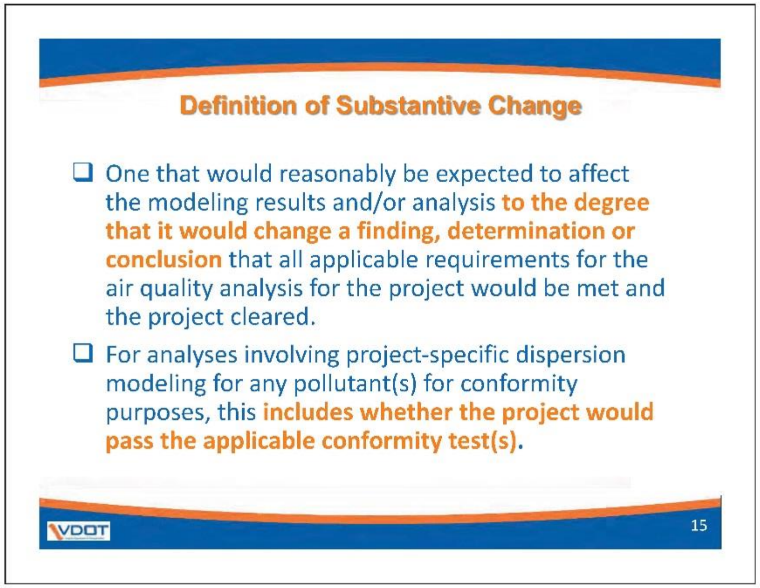
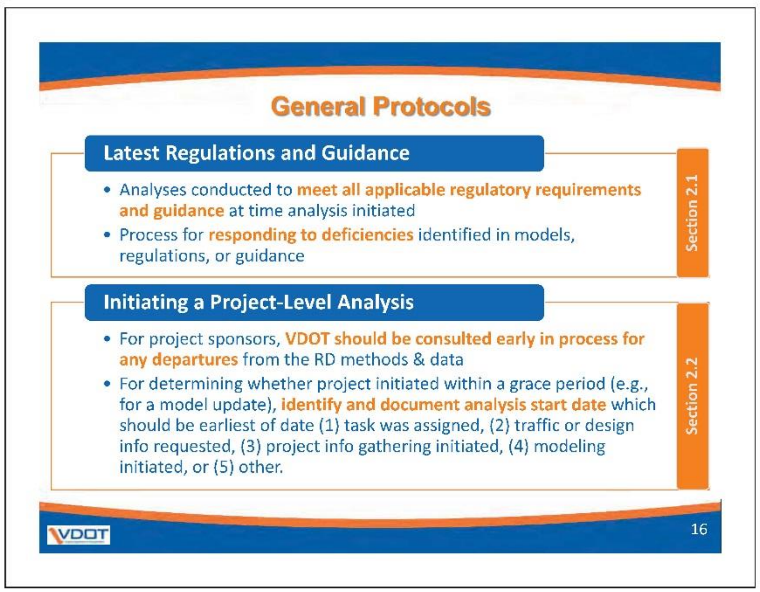

Definition of Substantive Change
One that would reasonably be expected to affect the modeling results and/or analysis to the degree that it would change a finding, determination or conclusion that all applicable requirements for the air quality analysis for the project would be met and the project cleared.
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


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
Section 2.1
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.
Section 2.2
VDOT
16

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**

VDOT 17

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, Affected 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

VDOT 18

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)

VDOT 19

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**

VDOT 20

General Protocols (continued)

Nearby Sources

Section 2.9

- 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

Section 2.10

- 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)

VDOT 21

General Protocols (continued)

Input Data and Files

Section 2.11

- 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

Section 2.12

- 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

VDOT 22

Resources for Conformity Analyses

Consultation Focus on Conformity

Online Data Repository (DR)	Project Assessment Methods and Criteria
CO Hot-Spot Analysis Resources	$PM_{2.5}$ Hot-Spot Analysis Resources

If the CALINE models removed by EPA, VDOT will transition to the model 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.**

VDOT 23

Online Data Repository

VDOT Environmental Website:

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

http://outsidevdot.cov.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)

VDOT 24

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.

VDOT 25

Project Assessment How Addressed in Resource Document

- Exempt Status
  - Provide link to the conformity rule
  - Include exempt tables in an appendix
- Categorical Findings
  - Provide link to FHWA finding (Currently only applicable to CO)
- Programmatic Agreements
  - Propose use for transportation conformity purposes
  - Provide link to available VDOT and FHWA agreements
- $PM_{2.5}$ Assessment Criteria
  - Proposed approach consistent with EPA guidance to streamline analyses (Discussed Later)

VDOT 26

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

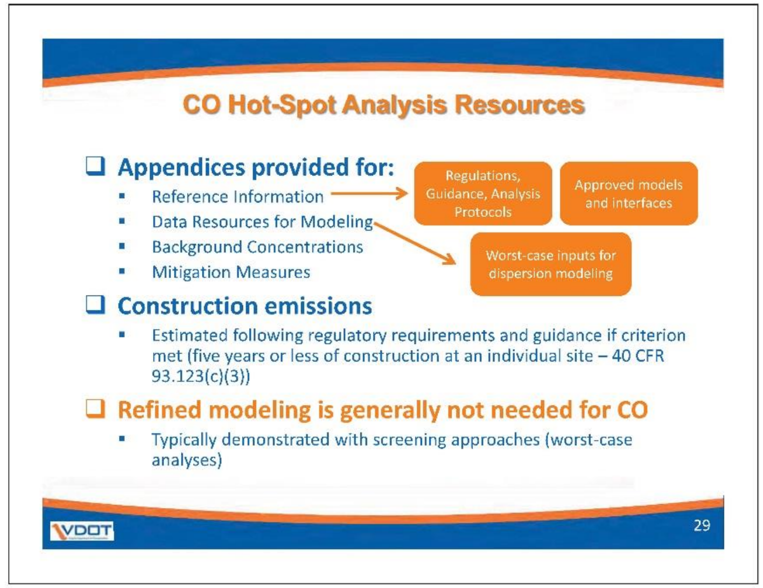
VDOT 27

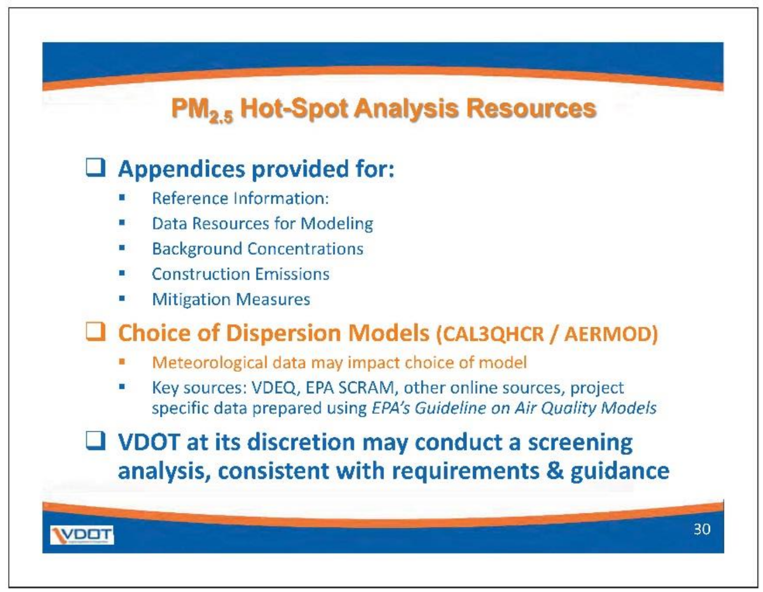
Application of PAs for Conformity Purposes

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.

VDOT 28


CO Hot-Spot Analysis Resources
Appendices provided for:
Reference Information
Data Resources for Modeling
Background Concentrations
Mitigation Measures
Regulations, Guidance, Analysis Protocols
Approved models and interfaces
Worst-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)
VDOT
29


PM2.5 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: VDEQ, 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
VDOT
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Resource Document
Document Appendices
VDOT
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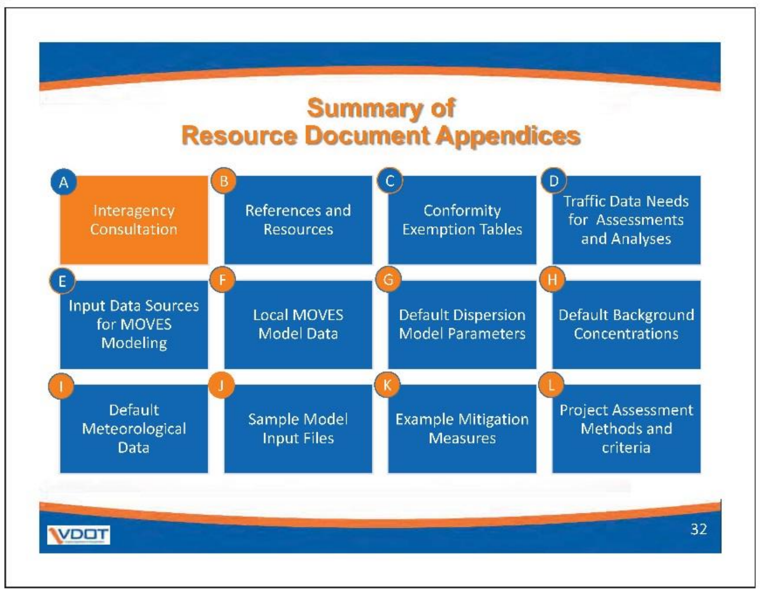

Summary of
Resource Document Appendices
A
Interagency Consultation
B
References and Resources
C
Conformity Exemption Tables
D
Traffic Data Needs for Assessments and Analyses
E
Input Data Sources for MOVES Modeling
F
Local MOVES Model Data
G
Default Dispersion Model Parameters
H
Default Background Concentrations
I
Default Meteorological Data
J
Sample Model Input Files
K
Example Mitigation Measures
L
Project Assessment Methods and criteria
VDOT
32

References and Resources (Appendix B)

REGULATIONS:

Agency	Regulation	Hyperlink	Pollutants: CO – Conf.	CO – NEPA	$PM_{2.5}$	MSATs	GHG	Relevant Content: Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
EPA	Clean Air Act (and amendments)	Link	■	■	■	■	■								
	Transportation Conformity Regulations (EPA-420-B-12-013)	Link	■		■										
	EPA Project-Level Conformity and Hot-Spot Analyses	Link													
	EPA's Guideline on Air Quality Models	Link	■	■	■										
	Air Toxics Final Rules	Link				■									
FHWA	FHWA Carbon Monoxide Categorical Hot-Spot Finding	Link	■												
	FHWA Transportation Planning Requirements and Their Relationship To NEPA Approvals	Link		■		■	■								
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	Link	■		■										
	VDOT Road and Bridge Specifications	Link	■	■	■	■	■								■
	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)	Link1 Link2 Link3	■	■	■	■	■								■

- Regulations
- Guidance
- Programmatic Agreements
- Modeling Tool Resources
- Resources for Research and Best Practices

VDOT 33

Local Emission Model Data (Appendix F)

- ❑ **MOVES Input Files**
  - MWCOG 2015 CLRP and FY2014-2020 TIP Conformity Files (MOVES2014)
  - VDEQ 2011 NEI (MOVES2014)
- ❑ **Templates to calculate link source type hour fractions using VDOT HPMS Reports**
- ❑ **Sample MOVES Run Specification Files (MRS)**
- ❑ **Files provided zipped in DR (MOVES.ZIP)**

MOVES Data Types Provided

- Vehicle Age
- Fuel Supply
- Fuel Formulation
- I/M Program
- Meteorology
- SourceTypePopulation

VDOT 34

Default CAL3QHC Dispersion Model Parameters (Appendix G)

- Emission Factor
- Surface Roughness
- Wind Speed / Direction
- Stability Class
- Mixing Height
- Setting and Deposition Velocity
- Link and Median Width
- Source / Receptor Height
- Receptor Locations
- Background Concentrations
- Persistence Factor
- Averaging Time
- Volumes / Flow Rates
- Signal Data

Parameter values reviewed with FHWA Resource Center

VDOT 35

Default CAL3QHC Dispersion Model Parameters *For Worst-Case (Screening) Analyses*

CAL3QHC Parameters	Typical Worst-Case Analysis Inputs
Emission Factor	• Typical Worst-Case: – Value for an emission factor that would be higher than that for the expected speed, based on typical curves for CO emission factors versus speed. • More Conservative Worst-Case: – For low speed scenarios, e.g., involving congested arterial street intersections: Emission factor for a speed at or relatively nearer the lower limit for the emission model, e.g. 5 mph for lower speed facilities, or – For Higher Speed Scenarios, e.g., highway projects: ▪ Worst-case conditions as specified in the federal guidance or related applications, e.g., 52 mph for LOS E operations (maximum emissions considering both concurrent changes in emission factors and traffic volumes for higher speed operations.) ▪ Emission factor for a speed at or relatively near the upper limit for the emission model. • Note: The standard (not worst-case) approach would be to select the emission factor for the forecast speed (if available) from an emission factor-speed tabulation created as noted above for MOVES.
Surface Roughness Coefficient (cm)	• Urban = 108 (consistent with FHWA CO Categorical Hot-Spot Finding) • Rural = 11 (grass) • For specific roughness, users can refer to EPA's CAL3QHC Guideline (see **Appendix B1**).

VDOT 36

Default CAL3QHC Dispersion Model Parameters
For Worst-Case (Screening) Analyses

Wind Speed (meters per second)	1.0
Wind Direction Increments (degrees, multipliers)	10 (1-36) (or more detailed)
Stability Class	• Urban Areas: 4 (D-Neutral) • Rural Areas: 5 (E)
Mixing Height (meters)	1000
Setting Velocity (cm/s)	0
Deposition Velocity (cm/s)	0
Median Width (ft)	• Streets: 0 • Freeways: 3 (or a minimum distance for a barrier).
Source Height (ft)	0
Receptor Height(ft)	5.9
Receptor Locations	Following applicable guidance for spacing, but with distance from the traveled roadway as follows for worst-case analyses: • Typical Worst-Case: Along the right of way edge, with defaults of 10 feet for arterial streets and 20 ft for freeways. • More Conservative Worst-Case: Along the edge of the mixing zone (which may be inside the right of way for many highway projects).

VDOT 37

Default CAL3QHC Dispersion Model Parameters
For Worst-Case (Screening) Analyses

Background Concentration (ppm)	0 (to determine the modeled project contribution to the ambient levels, without background) Note: Background concentrations are tabulated separately (see **Appendix H**) and added to the modeled project contribution to get the estimated ambient concentration for comparison to the NAAQS.
Persistence Factor	0.78 default (NOVA) 0.77 default (rest of Virginia) 0.83 maximum (all of Virginia) See **Appendix G2** for calculation methodology
Averaging Time (min)	60min
Volumes (vehicle per hour) (vph)	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. Values below based on HCM 2010 version*: • Freeway = 2400 vehicles per hour per lane (veh/h/ln) times the number of lanes • 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 – Metropolitan Areas = 1,230 (veh/h/ln) x number of lanes – Other Areas = 1,130 (veh/h/ln) x number of lanes ** 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.*

VDOT 38

Default CAL3QHC Dispersion Model Parameters
For Worst-Case (Screening) Analyses

Saturation Flow Rate (veh/h/ln)	Defaults based on saturation flow rates from the current HCM. Values below based on HCM 2010 version (Exhibit 18-28)*: • 1,900 veh/h/ln (Metropolitan area with population>250,000) • 1,750 veh/h/ln (Other than above) ** Saturation flow rates from HCM are in passenger car units/h/ln. Values were used to estimate CAL3QHC inputs in veh/h/ln.*
Signal Data	Defaults from the current HCM and CAL3QHC software user's guide unless project-specific data available. Per current resources: • Defaults per HCM 2010 (Exhibit 18-28) and the CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised)): – Signal Type = 1 (pretimed) – Arrival Rate = 3 (average) • Defaults per CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised): – Clearance Lost Time (s) = 2 • Worst-case defaults where project-specific information are not available: – Average Cycle Length (s): 120 – Average Red Time Length (s): 68 • 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: http://ops.fhwa.dot.gov/publications/fhwahop08024/chapter3.htm.

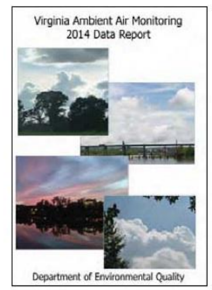
VDOT 39

Default Background Concentrations (Appendix H)

- Defaults Prepared by VDOT
  - Based on monitor trends and design values
  - To be updated on periodic basis based on new monitoring information
- Alternative values may be determined on a project-specific basis following the general approach outlined in the RD or EPA guidance
  - Appropriate documentation of the underlying data and calculation provided with the analysis in those cases

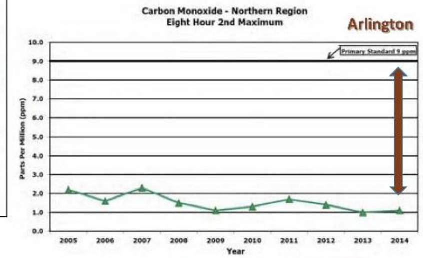
VDOT 40

CO Monitor Trends for NOVA



National Ambient Air Quality Standards (NAAQS)

Primary Standard for CO:
- 8-hour average not to exceed 9 ppm (10 mg/m[3]) more than once per year.
- 1-hour average not to exceed 35 ppm (40 mg/m[3]) more than once per year.

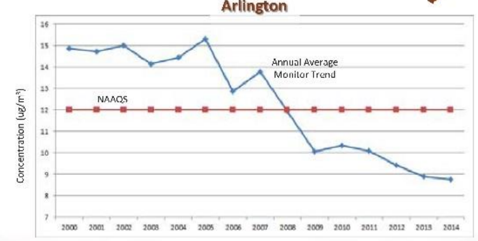


VDOT 41

$PM_{2.5}$ Monitor Trends for NOVA

Table 2a: $PM_{2.5}$ Design Values for Virginia Monitors

2011-2013 PM2.5 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	8.8**
8		511071005	Loudoun	8.9



http://www3.epa.gov/airtrends/pm.html

VDOT 42

Default Background Concentrations

- **Currently based on 2011-2013 monitor data**
  - CO – 2nd maximum concentration for most recent two year period
  - $PM_{2.5}$ – 3 year average of annual 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

Table 4: Default $PM_{2.5}$ Background Concentrations for Northern Virginia

Region	Background Concentration (µg/m3) Annual
Arlington County & Alexandria City	9.4
Remaining Jurisdictions	8.9

VDOT 43

Default Meteorological Data for $PM_{2.5}$ 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

VDOT 44

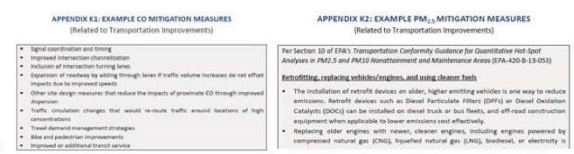
Sample Project Level Input Files (Appendix J)

- ❑ Sample dispersion model input files provided as resource for project-level analyses
- ❑ Included in DR
  - CAL3QHC.ZIP (Sample inputs with worst-case defaults)
  - CAL3QHCR.ZIP (Sample inputs and run outputs)
  - AERMOD.ZIP (Sample inputs and run outputs)

VDOT 45

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



VDOT 46

Resource Document
Discussion

VDOT 47

2 $PM_{2.5}$ Project Assessment Criteria
Overview of Criteria

VDOT 48

$PM_{2.5}$ Assessment Criteria

Assessment Level	Who Makes Decision?
LEVEL 1 Is the project exempt?	VDOT
LEVEL 2 Is the project clearly not of AQ concern?	VDOT (Using ICG-Reviewed Resource Document)
LEVEL 3 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"

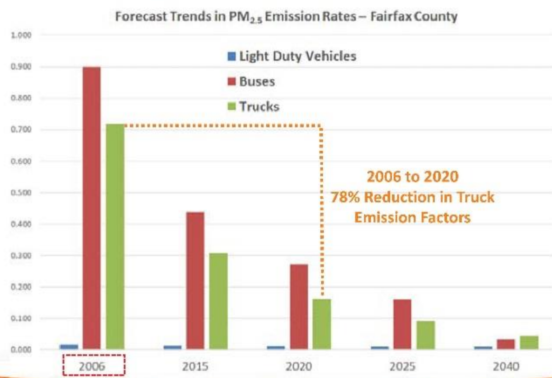
VDOT 49

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**
- ❑ **$PM_{2.5}$ Background Concentrations**

VDOT 50

Emission Rate Trends



VDOT 51

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 busses and/or diesel trucks.

VDOT 52

$PM_{2.5}$ Assessment Criteria
New Highway Construction

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

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

VDOT 53

$PM_{2.5}$ Assessment Criteria
Highway Capacity Expansion

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?		
Yes	**No**	
Clearly Not A Project of Air Quality Concern	Is the opening year diesel AADTT at or below the threshold listed above for New Highway Construction?	
	Yes	**No**
	Clearly Not a Project of Air Quality Concern	Additional Review Required

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

VDOT 54

$PM_{2.5}$ Assessment Criteria
Intersections

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

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?		
Yes	**No**	
Clearly Not A Project of Air Quality Concern	Is the opening year diesel AADTT at or below the threshold listed above for New Highway Construction or, is the increase in diesel AADTT (if any) less than or equal to the threshold specified above for Highway Capacity Expansion?	
	Yes	**No**
	Clearly Not a Project of Air Quality Concern	Additional Review Required

VDOT 55

EPA Conformity Rule / Guidance Examples

(Transit / Intermodal)

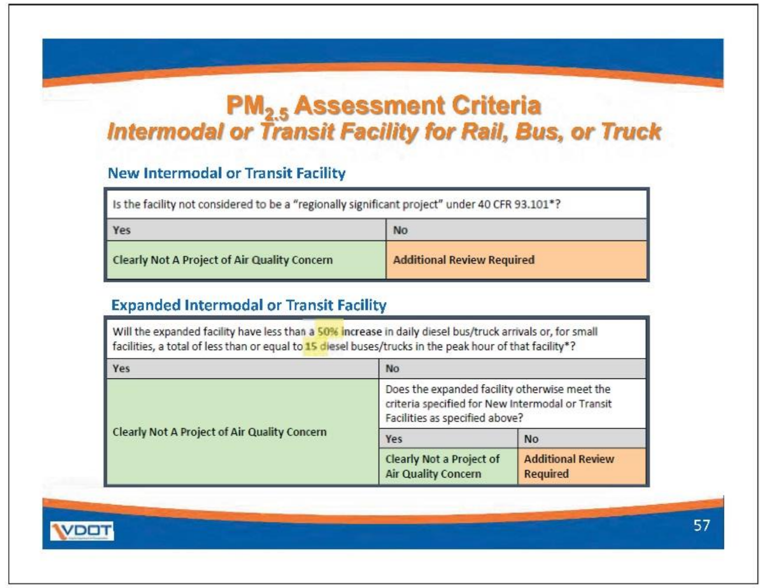
Some examples of projects of local air quality concern that would be covered by 40 CFR 93.123(b)(1)(iii) and (iv) are:

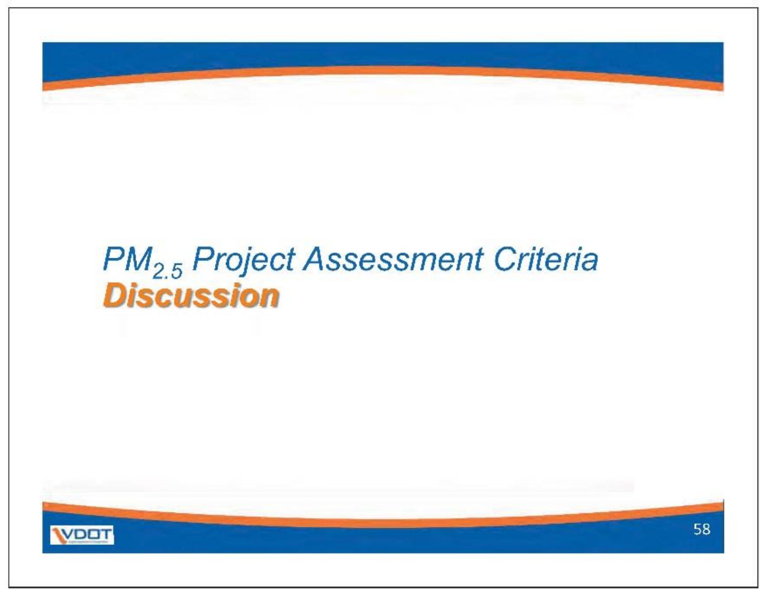
- A major new bus or intermodal terminal that is considered to be a "regionally significant project" under 40 CFR 93.101[2]; and,
- An existing bus or intermodal terminal that has a large vehicle fleet where the number of diesel buses increases by 50% or more, as measured by bus arrivals.

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).

VDOT 56


PM2.5 Assessment Criteria
Intermodal or Transit Facility for Rail, Bus, or Truck
New Intermodal or Transit Facility
Is the facility not considered to be a "regionally significant project" under 40 CFR 93.101*?
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 50% increase in daily diesel bus/truck arrivals or, for small facilities, a total of less than or equal to 15 diesel buses/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
Clearly Not a Project of Air Quality Concern
Additional Review Required
57


PM2.5 Project Assessment Criteria
Discussion
58

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	$PM_{2.5}$	MSATs	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
EPA	Clean Air Act (and amendments)	Link	■	■	■	■	■								
EPA	Transportation Conformity Regulations (EPA-420-B-12-013)	Link	■		■			■	■						
EPA	EPA's Guideline on Air Quality Models	Link	■	■	■					■	■				
FHWA	FHWA Carbon Monoxide Categorical Hot-Spot Finding	Link	■					■	■						
FHWA	FHWA Transportation Planning Requirements and Their Relationship to NEPA Approvals	Link		■		■	■	■	■						
VA	Virginia Regulation for Transportation Conformity (9 VAC 5-151) The Virginia regulation reflects the requirements of the federal rule for inter-agency and public consultation. Note 9VAC5-151-20B states in part that "*The provisions of this chapter shall not apply in nonattainment and maintenance areas that were designated nonattainment or maintenance under a federal standard that has been revoked (see 9VAC5-20-204 B)*."	Link	■		■			■	■						
VA	VDOT Road and Bridge Specifications	Link	■	■	■	■	■								■
VA	DEQ Air Pollution Regulations 9 VAC 5-130 (Open Burning Restrictions) 9 VAC 5-50 (Fugitive Dust Precautions) 9 VAC 5-45 (Asphalt Paving Operations)	Link1 Link2 Link3	■	■	■	■	■								■

GUIDANCE:

Agency	Document	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	$PM_{2.5}$	MSATs	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
EPA	EPA Project-Level Conformity and Hot-Spot Analyses (Webpage with links to multiple guidance documents)	Link	■		■				■	■		■			
EPA	Transportation Conformity Guidance for Quantitative Hot-spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas (EPA-420-B-15-084)	Link			■				■	■		■			
EPA	Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA-454/R-92-005)	Link	■	■						■		■			
EPA	Using MOVES2014 in Project-Level Carbon Monoxide Analyses (EPA-420-B-15-028)	Link	■	■						■		■			
FHWA	FHWA Air Quality	Link	■	■	■	■				■					
FHWA	FHWA Technical Advisory T6640.8A October 30, 1987	Link		■		■	■	■	■	■					
FHWA	Updated Interim Guidance on Mobile Source Air Toxic Analysis in NEPA Documents	Link				■			■	■					
FHWA	A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives	Link				■				■					
FHWA	Frequently Asked Questions (FAQ) Conducting Quantitative MSAT Analysis for FHWA NEPA Documents.	Link				■				■					
FHWA	Interim Guidance: Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process (Federal Highway Administration (FHWA), 2003)	Link					■		■	■					

APPENDIX B2: NATIONAL AND VDOT PROGRAMMATIC AGREEMENTS

	Programmatic Agreement Name	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	$PM_{2.5}$	MSATs	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Documentation
VDOT Agreements	FHWA-VDOT, “Programmatic Agreement for Project-Level Air Quality Analyses for Carbon Monoxide”, 2016	Link	■	■					■						■
	FHWA-VDOT, “Project-Level Carbon Monoxide Air Quality Studies Agreement”, letter agreement executed February 27, 2009.	Link	■	■				■	■						■
	FHWA-VDOT, “No-Build Analysis Agreement for Air and Noise Studies”, letter agreement dated May 22, 2009.	Link	■	■						■					
	FHWA-VDOT, “Procedures for Updating Air Studies When New Planning Assumptions Become Available”, letter agreement dated October 28, 2004.	Link	■	■						■					

APPENDIX B3: RESOURCES FOR MODELING TOOLS

	Modeling Tool Reference	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	$PM_{2.5}$	MSATs	IECI	Exemptions	Analysis Level	Analysis Method	Model Software	Default Data	Local Data	Concentrations	Construction
Modeling Tool Resources	EPA's MOVES Website for Software Download	Link	■	■	■	■					■				
	EPA's SCRAM Website for Dispersion Model Software Download	Link	■	■	■	■					■				
	FHWA Office of Planning, Environment, & Realty Models and Methodologies	Link	■	■	■	■					■				
	FHWA Resource Center – Air Quality Team References to Interface and Utility Software	Link	■	■	■	■					■				
	NCHRP 25-38 Input Guidelines for MOVES	Link													
	NCHRP 25-48: Combined Interface for Project Level Air Quality Analysis	Link	■	■	■	■					■				
	NCHRP 25-25 Task 96, "Quick Reference Guide for Traffic Modelers for Generating Traffic and Activity Data for Project-Level Air Quality Analyses", 2018	Link	■	■	■	■			■	■		■			
	NCHRP 765, "Analytical Travel Forecasting Approaches for Project-Level Planning and Design, 2014	Link								■					
	NCHRP 08-101, "Enhanced Truck Data Collection and Analysis for Emissions Modeling", 2018	Link								■					
	Emissions Factors & AP 42, Compilation of Air Pollutant Emission Factors, EPA	Link	■	■	■	■						■			■

APPENDIX B4: RESOURCES FOR RESEARCH AND BEST PRACTICES

	Reference / Resource Name	Hyperlink	Pollutants					Relevant Content							
			CO – Conf.	CO - NEPA	$PM_{2.5}$	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	Link	■		■										
Background Information	National Ambient Air Quality Standards	Link	■		■										
Background Information	Transportation Conformity (FWHA)	Link	■		■										
Background Information	Transportation Conformity (EPA)	Link	■		■										
Background Information	FHWA Air Quality Information	Link	■	■	■	■									
Background Information	Federal Highway Legislation and Regulations	Link		■		■									
Background Information	FHWA's Resource Center Website (Air Quality Team)	Link	■	■	■	■	■			■	■				
Other Technical Resources	A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives	Link				■				■					
Other Technical Resources	Virginia Ambient Air Monitoring Data Reports, DEQ Office of Air Quality Monitoring	Link	■	■	■									■	
Other Technical Resources	EPA Air Data Monitoring Website	Link	■	■	■									■	
Other Technical Resources	FHWA NEPA Training for Project-Level Air Quality Analyses (provided in VDOT Online Data Repository)	Link	■	■	■	■			■	■	■	■	■	■	■
Other Technical Resources	AASHTO Practitioner's Handbook: Indirect Effects and Cumulative Impacts Assessments	Link					■		■	■					
Other Technical Resources	NCHRP Report 466: Desk Reference for Estimating the Indirect Effects of Proposed Transportation Projects	Link					■		■	■					
Other Technical Resources	TRB Transportation & Air Quality (ADC20) Project-Level Analyses	Link	■	■	■	■	■			■					
Other Technical Resources	NCHRP 25-25 Task 70: Assessment of Quantitative Mobile Source Air Toxics in Environmental Documents	Link				■			■	■	■				
Other Technical Resources	NCHRP 25-25 Task 78: Programmatic Agreements for Project-Level Air Quality Analyses	Link	■						■						
Other Technical Resources	NCHRP 25-25 Task 104: "Streamlining Carbon Monoxide Project-Level Air Quality Analyses with Programmatic Agreements", (2018 in progress)	Link	■						■						
Other Technical Resources	NCHRP 25-25 Task 89: Establishing Representative Background Concentrations for Quantitative Hot-spot Analyses for Particulate Matter	Link			■							■	■		
Other Technical Resources	CEQ Memorandum. Guidance on the Consideration of Past Actions in Cumulative Effects Analysis. 6/2005.	Link					■		■	■					

APPENDIX C: CONFORMITY EXEMPTION TABLES

This is the current version of the EPA table at the time of preparation of this document.

Modelers should check the EPA regulation for the latest version of the table for reference in their analyses.

Projects Exempt from Project-level and Regional Conformity Analyses[29]

Federal Conformity Rule, 40 CFR 93.126 - Table 2: Exempt Projects[30]

Table 2—Exempt Projects

Safety

Railroad/highway crossing.
Projects that correct, improve, or eliminate a hazardous location or feature.
Safer non-Federal-aid system roads.
Shoulder improvements.
Increasing sight distance.
Highway Safety Improvement Program implementation.
Traffic control devices and operating assistance other than signalization projects.
Railroad/highway crossing warning devices.
Guardrails, median barriers, crash cushions.
Pavement resurfacing and/or rehabilitation.
Pavement marking.
Emergency relief (23 U.S.C. 125).
Fencing.
Skid treatments.
Safety roadside rest areas.
Adding medians.
Truck climbing lanes outside the urbanized area.
Lighting improvements.
Widening narrow pavements or reconstructing bridges (no additional travel lanes).
Emergency truck pullovers.

Mass Transit

Operating assistance to transit agencies.
Purchase of support vehicles.
Rehabilitation of transit vehicles[1].
Purchase of office, shop, and operating equipment for existing facilities.
Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.).
Construction or renovation of power, signal, and communications systems.
Construction of small passenger shelters and information kiosks.
Reconstruction or renovation of transit buildings and structures (e.g., rail or bus buildings, storage and maintenance facilities, stations, terminals, and ancillary structures).
Rehabilitation or reconstruction of track structures, track, and trackbed in existing rights-of-way.
Purchase of new buses and rail cars to replace existing vehicles or for minor expansions of the fleet[1].
Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771.

Air Quality

Continuation of ride-sharing and van-pooling promotion activities at current levels.
Bicycle and pedestrian facilities.

Other

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.

Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action.
Noise attenuation.
Emergency or hardship advance land acquisitions (23 CFR 710.503).
Acquisition of scenic easements.
Plantings, landscaping, etc.
Sign removal.
Directional and informational signs.
Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities).
Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational or capacity changes.

Note: [1] In PM_{10} and $PM_{2.5}$ nonattainment or maintenance areas, such projects are exempt only if they are in compliance with control measures in the applicable implementation plan.

29 Note EPA clarifications to exempt projects are provided in their response to Question 6 in "PM Hot-spot Analyses: Frequently Asked Questions", EPA-420-F-18-011, June 2018.
Link: https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses#pmguidance
Direct link: https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100UKQS.pdf

30 Text version: https://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol21/xml/CFR-2013-title40-vol21-sec93-126.xml

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-2013-title40-vol21/xml/CFR-2013-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 $PM_{2.5}$ 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 $PM_{2.5}$ LEVEL OF ANALYSIS DETERMINATION

Data
▪ Type of project improvement including any major developments or intermodal facilities (especially those resulting in increased diesel truck traffic) linked to the improvement. ▪ 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. ▪ If available, traffic analyses indicating No-Build and Build Level of Service (LOS) at high volume intersections and/or interchanges ▪ Information on relevant intermodal terminals including peak hour arrivals for trucks and buses.

APPENDIX D2: DATA NEEDS FOR CO LEVEL OF ANALYSIS DETERMINATION

Data	Typical Sources
Type of project improvement	▪ Project description
No-Build and Build Average Daily Traffic (ADT) for design year at worst-case intersection locations	▪ Traffic analyses and forecasts conducted for study (e.g. modeling or simulation) ▪ Regional travel modeling
No-Build and Build Level of Service (LOS) for design year at worst-case intersection locations	▪ Traffic analyses and forecasts conducted for study (modeling, simulation, Highway Capacity Manual analyses) ▪ Other post processing methodologies employing principles from the Highway Capacity Manual.
Proposed intersection skew angles	▪ Intersection design

APPENDIX D3: DATA NEEDS FOR MSAT LEVEL OF ANALYSIS DETERMINATION

Data	Typical Sources
Type of project improvement including any major developments or intermodal facilities linked to the improvement.	▪ Project description.
Design Year No-Build and Build ADT at highest volume location in study area.	▪ Traffic analyses and forecasts conducted for study (modeling, simulation, Highway Capacity Manual analyses)
Proximity of project to populated areas.	▪ Project Aerials or Google Earth imagery. ▪ GIS land cover maps

APPENDIX E: INPUT DATA SOURCES FOR MOVES MODELING

E1: Input Data Sources for CO MOVES Modeling

E2: Input Data Sources for $PM_{2.5}$ 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
Links (average speed, traffic volume, length, road type, grade)	Options: ▪ 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 ▪ Worst-case volume and speed assumptions (which are listed in **Appendix G1** with the inputs for the dispersion model CAL3QHC).
Link Source Type Hour Fraction (distribution among MOVES vehicle types for each link and hour)	Options include but are not limited to: ▪ 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. An optional spreadsheet tool has been developed to assist with calculations and is provided in the online data repository (under the "LinkSourceType_Calculation" folder) ▪ "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 ▪ Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (http://www.virginiadot.org/info/ct-TrafficCounts.asp) or the national or periodic emission inventory for the closest or most recent year to the desired modeling year for the project-level analysis.
Link Drive Schedule (second by second speed inputs for each link; optional) Operating Mode Distribution (operating mode fraction data for each link; optional)	▪ Project-specific data and forecasts provided by traffic engineering/planning staff. ▪ *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.*
Off-Network Link (vehicles generating starts, extended idling)	▪ Project-specific data and forecasts from traffic engineering/planning staff. ▪ *Note: CO analyses generally focus on on-road emissions. Off-network start and extended idling emissions are not considered in CO analysis unless the project involves an off-network facility such as a parking lot, terminal etc.*
Vehicle Age Distribution Fuel Formulation Fuel Supply I/M Parameters Temperatures / Humidity Alternative Vehicle and Fuel Technologies (AVFT)	▪ 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). ▪ MOVES fuel and AVFT default values recommended unless and until region specific values are developed. ▪ *Note: Consistent with Department protocols, worst-case values may be applied at the discretion of the Department for certain inputs.*

APPENDIX E2: INPUT DATA SOURCES FOR $PM_{2.5}$ MOVES MODELING

MOVES PDM Input	Typical Sources of Information
Links (average speed, traffic volume, length, road type, grade)	▪ Project-specific data and forecasts provided by traffic engineering/ planning staff.
Link Source Type Hour Fraction (distribution among MOVES vehicle types for each link and hour)	Options include but are not limited to: ▪ 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. An optional spreadsheet tool has been developed to assist with calculations and is provided in the online data repository (under the "LinkSourceType_Calculation" folder) ▪ "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 ▪ Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (http://www.virginiadot.org/info/ct-TrafficCounts.asp) or the national or periodic emission inventory for the closest or most recent year to the desired modeling year for the project-level analysis.
Link Drive Schedule (second by second speed inputs for each link; optional) Operating Mode Distribution (operating mode fraction data for each link; optional)	▪ Project-specific data and forecasts from traffic engineering/planning staff. ▪ *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.*
Off-Network Link (vehicles generating starts, extended idling)	▪ Project-specific data and forecasts provided by traffic engineering/planning staff. ▪ *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*
Vehicle Age Distribution Fuel Formulation Fuel Supply I/M Parameters Temperatures / Humidity Alternative Vehicle and Fuel Technologies (AVFT)	▪ 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). ▪ MOVES fuel and AVFT default values recommended unless and until region specific values are developed.

APPENDIX E3: INPUT DATA SOURCES FOR MSAT MOVES MODELING

MOVES CDM Input	Typical Sources of Information and Preparation Methods
HPMS VMT Vehicle Type/Year	**Preferred Data Source** ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data for the affected network links (as defined in **Section 4.5.1**). ▪ 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. **Other Options (Supplemental or in Absence of Project-Specific Data)** ▪ 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. ▪ Regional air quality conformity and/or periodic emission inventory input data to support disaggregation of VMT to MOVES input vehicle classes.
Average Speed Distribution	**Preferred Data Source** ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data for the affected network links (as defined in **Section 4.5.1**). ▪ 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. ▪ Preferred methods include travel model post processing procedures to estimate congested speeds by time period and to support the input formats needed by MOVES. ▪ 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. **Other Options (Supplemental or in Absence of Project-Specific Data)** ▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation.

Road Type Distribution	**Preferred Data Source** ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data for the affected network links (as defined in **Section 4.5.1**). ▪ 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. **Other Options (Supplemental or in Absence of Project-Specific Data)** ▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation. ▪ Regional (including jurisdictional) VMT or VHT distributions, for example as available from VDOT (http://www.virginiadot.org/info/ct-TrafficCounts.asp).
Ramp Fractions	**Preferred Data Source** ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data for the affected network links (as defined in **Section 4.5.1**). ▪ 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. **Other Options (Supplemental or in Absence of Project-Specific Data)** ▪ Regional air quality conformity and/or periodic emission inventory input data if analysis networks are consistent with the affected network and project representation. ▪ MOVES default values (i.e. 8% of restricted road VHT)
Monthly VMT Distribution Daily VMT Distribution Hourly VMT Fraction	**Preferred Data Source** ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data for the affected network links (as defined in **Section 4.5.1**). ▪ Preferred data sources can include regional air quality conformity and/or periodic emission inventory input data. **Other Options (Supplemental or in Absence of Project-Specific Data)** ▪ MOVES emission model defaults

Source Type Population	**Preferred Data Source** ▪ 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. ▪ Per guidance and FHWA training materials referenced in **Section 4.5**, utilize project-specific data if available, otherwise MOVES defaults may be estimated per FHWA training material methods. ▪ Regional air quality conformity and/or periodic emission inventory input data.
Vehicle Age Distribution Fuel Formulation Fuel Supply I/M Parameters Temperatures/Humidity Alternative Vehicle and Fuel Technologies (AVFT)	**Preferred Data Source** ▪ 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). ▪ MOVES fuel and AVFT default values recommended unless and until region specific values are developed.

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

F1: Northern Virginia MOVES Data

F2: Virginia Remaining State MOVES Data

APPENDIX F1: DEFAULT MOVES INPUTS FOR PROJECTS IN NORTHERN VIRGINIA

Data Source*:	MWCOG Regional Conformity Files and VDEQ Files for the most recent National Emission Inventory (NEI version 2, for 2014), in MOVES2014a format
Years:	2014, 2025, 2030, 2040
File Formats:	County Data Manager (CDM) Inputs
File Download Link:	http://www.virginiadot.org/programs/pr-environmental.asp http://outsidevdot.cov.virginia.gov Registration Required

** Files prepared for the most recent regional conformity analysis, national emission inventory, SIP development, or other regional analysis should 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. Note the data referenced here may be superseded by later analyses than were available at the time of preparation of this report.*

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	• SourceTypeID • YearID • AgeID • AgeFraction	• Data modification for interim years (files not available for the specific year): – 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. – <Optional> EPA provides an age distribution projection tool for MOVES2014 (See: http://www.epa.gov/otaq/models/moves/tools.htm). 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.
Fuel Supply	Provides fuel properties	• fuelRegionID • FuelYearID • MonthGroupID • FuelFormulationID • MarketShare • MarketShareCV	• *Note: With MOVES2014a, and consistent with EPA guidance, default fuel data are now typically applied for jurisdictions in Virginia*
Fuel Formulation		• FuelFormulationID • FuelSubtypeID • RVP • SulfurLevel • ETOHVolume • MTBEVolume • ETBEVolume • TAMEVolume • Etc.	
Fuel Usage Fraction		• CountyID • FuelYearID • ModelYearGroupID • SourceBinFuelTypeID • FuelSupplyFuelTypeID • UsageFraction	

I/M Programs	Provides I/M program parameters	• polProcessID • stateID • countyID • yearID • sourceTypeID • fuelTypeID • IMProgramID • inspectFreq • testStandardsID • begModelYearID • endModelYearID • useIMyn • complianceFactor	• Data modification for other years: – For years beyond 2025, use 2025 IM input table as a base. – Update "YearID" field with the calendar year to be modeled (e.g. 2027). – Select records with "endModelYearID" greater than 1995. – Update "endModelYearID" to be ("YearID"- 4)
Meteorology	Provides temperatures and humidity inputs	• MonthID • ZoneID • HourID • Temperature • RelHumidity	• Inputs modification: no modification is required for using inputs from available years.
Source Type Population	Supplemental source for estimating link source type hour fraction inputs (see App.E1-E3)	• YearID • SourceTypeID • SourceTypePopulation	• 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. • The role of the data would be to disaggregate known traffic categories determined from VDOT data sources into the 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)

APPENDIX F2: DEFAULT MOVES INPUTS FOR PROJECTS OUTSIDE NORTHERN VIRGINIA

Data Source*:	VDEQ Files for the most recent National Emission Inventory (NEI version2)
Year:	2014
File Formats:	County Data Manager (CDM) Inputs
File Download Link:	http://www.virginiadot.org/programs/pr-environmental.asp http://outsidevdot.cov.virginia.gov Registration Required

** As of the date of preparation of this report, no jurisdictions in Virginia are subject to federal conformity requirements for pollutants for which project-level air quality analyses would be needed. Further, no jurisdictions in Virginia outside northern Virginia are subject to federal conformity requirements for pollutants for which regional 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. The data referenced here may be superseded by later analyses than were available at the time of preparation of this report.*

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	• SourceTypeID • YearID • AgeID • AgeFraction	• Data modification for other years: – 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. – <OPTIONAL> EPA provides age distribution projection tool for MOVES2014 (See: http://www.epa.gov/otaq/models/moves/tools.htm). The tool creates projections of future year age distribution based on current local age distributions.
Fuel Supply	Provides fuel properties	• fuelRegionID • FuelYearID • MonthGroupID • FuelFormulationID • MarketShare • MarketShareCV	• Fuel inputs are available for MOVES2014 input format. • *Note: With MOVES2014a, and consistent with EPA guidance, EPA default fuel data are now typically applied for jurisdictions in Virginia.*
Fuel Formulation		• FuelFormulationID • FuelSubtypeID • RVP • SulfurLevel • ETOHVolume • MTBEVolume • ETBEVolume • TAMEVolume • Etc.	
Fuel Usage Fraction		• CountyID • FuelYearID • ModelYearGroupID • SourceBinFuelTypeID • FuelSupplyFuelTypeID • UsageFraction	

I/M Programs	Provides I/M program parameters	• polProcessID • stateID • countyID • yearID • sourceTypeID • fuelTypeID • IMProgramID • inspectFreq • testStandardsID • begModelYearID • endModelYearID • testStandardID • useIMyn • complianceFactor	• Data modification for other years: – For years beyond 2014, use 2014 IM input table as a base. – Update "YearID" field with the calendar year to be modeled (e.g. 2017). – Select records with "endModelYearID" greater than 1995 and "useimyn" is "Y". – Update "endModelYearID" to be ("YearID"- 4) • If a county does not have IM programs in place, no input data will be provided in the IM input file for that county.
Meteorology	Provides temperatures and humidity inputs	• MonthID • ZoneID • HourID • Temperature • RelHumidity	• Inputs modification: no modification is required for using inputs from available years.
Source Type Population	Supplemental source for estimating link source type hour fraction inputs (see App.E1-E3)	• YearID • SourceTypeID • SourceTypePopulation	• 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. • The role of the data would be to disaggregate known traffic categories determined from VDOT data sources into the MOVES source types. An optional spreadsheet tool has been developed to assist with calculations and is provided in the online data repository (under the "LinkSourceTypeHour_Calculation Tool" folder)

APPENDIX G: DEFAULT DATA FOR PROJECT-LEVEL ANALYSIS

G1: CAL3QHC Default & Worst-Case Parameters

G2: CO Persistence Factor Calculation

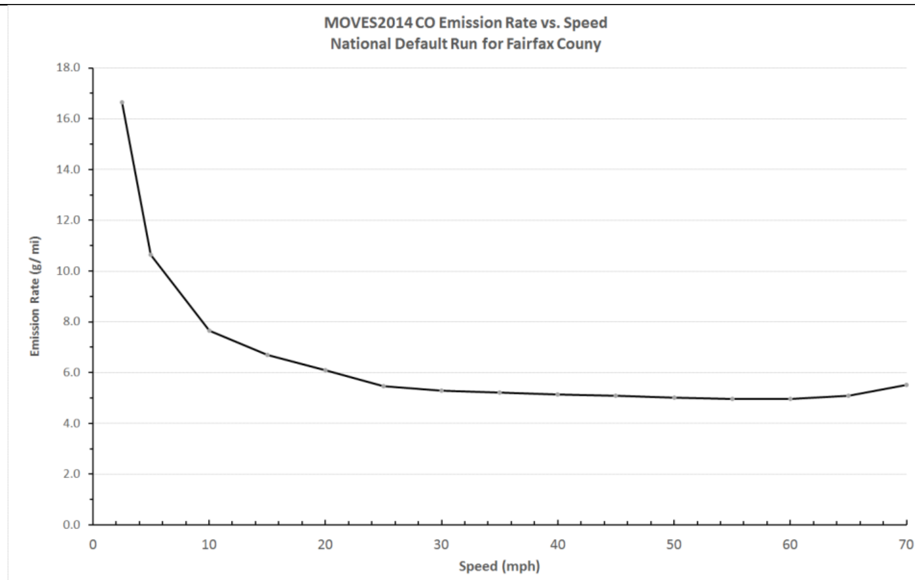
G3: Dispersion Model Defaults for PM Analyses

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. Note, worst-case modeling is generally done with a combination of typical and worst-case inputs; otherwise, if all possible worst-case inputs were to be combined in one modeling run, the end result may be excessively high.

CAL3QHC Parameters	Typical Worst-Case Analysis Inputs

Emission Factor	▪ Emission factors are typically developed using the EPA guidance and model resources provided in **Appendix B1-B3**. Emission factors are developed for free-flow and queueing links, as appropriate for the project.
	▪ To support screening-level analyses, assumed travel speeds input to EPA's MOVES emission model for emission factor calculations are as follows:
	  ▪ Queueing Links (Idling) = 0 mph
	  ▪ Free-flow Links can be estimated using the options provided below:
	    − Posted speed limit
	    − Methods based on the current version of the Highway Capacity Manual (HCM)
	    − Methods provided in EPA's Guideline for Modeling Carbon Monoxide from Roadway Intersections (EPA-454/R-92-005) as referenced in **Appendix B1**.
	    − *Alternative Worst-Case Approach*: 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.
	▪ 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.

	
Surface Roughness Coefficient (cm)	▪ Urban = 108 (consistent with FHWA CO Categorical Hot-Spot Finding) ▪ Rural = 11 (grass) ▪ For specific roughness, users can refer to EPA's CAL3QHC Guideline (see **Appendix B1**).
Wind Speed (meters per second)	1.0
Wind Direction Increments (degrees, multipliers)	10 (1-36) (or more detailed)
Stability Class	▪ Urban Areas: 4 (D-Neutral) ▪ Rural Areas: 5 (E)
Mixing Height (meters)	1000
Setting Velocity (cm/s)	0
Deposition Velocity (cm/s)	0
Median Width (ft)	▪ Streets: 0 ▪ Freeways: 3 (or a minimum distance for a barrier).
Source Height (ft)	0
Receptor Height(ft)	5.9

Receptor Locations	Following applicable guidance for spacing, but with distance from the traveled roadway as follows for worst-case analyses: ▪ Typical Worst-Case: Along the right of way edge, with defaults of 10 feet for arterial streets and 20 ft for freeways. ▪ More Conservative Worst-Case: Along the edge of the mixing zone (which may be inside the right of way for many highway projects).
Background Concentration (ppm)	0 (to determine the modeled project contribution to the ambient levels, without background) Note: Background concentrations are tabulated separately (see **Appendix H**) and added to the modeled project contribution to get the estimated ambient concentration for comparison to the NAAQS.
Persistence Factor	0.78 default (NOVA) 0.77 default (rest of Virginia) 0.83 maximum (all of Virginia) See **Appendix G2** for calculation methodology
Averaging Time (min)	60
Volumes (vehicle per hour) (vph)	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. Values below based on HCM 2010 version*: ▪ Freeway = 2400 vehicles per hour per lane (veh/h/ln) times the number of lanes ▪ 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 – Metropolitan Areas = 1,230 (veh/h/ln) x number of lanes – Other Areas = 1,130 (veh/h/ln) x number of lanes ** 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.*
Saturation Flow Rate (veh/h/ln)	Defaults based on saturation flow rates from the current HCM. Values below based on HCM 2010 version (Exhibit 18-28)*: ▪ 1,900 veh/h/ln (Metropolitan area with population>250,000) ▪ 1,750 veh/h/ln (Other than above) ** Saturation flow rates from HCM are in passenger car units/h/ln. Values were used to estimate CAL3QHC inputs in veh/h/ln.*

Signal Data	Defaults from the current HCM and CAL3QHC software user's guide unless project-specific data available. Per current resources: ▪ Defaults per HCM 2010 (Exhibit 18-28) and the CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised)): − Signal Type = 1 (pretimed) − Arrival Rate = 3 (average) ▪ Defaults per CAL3QHC User's Guide (1995)(EPA-454/R-92-006 (Revised): − Clearance Lost Time (s) = 2 ▪ Worst-case defaults where project-specific information is not available: − Average Cycle Length (s): 120 − Average Red Time Length (s): 68 ▪ 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: http://ops.fhwa.dot.gov/publications/fhwahop08024/chapter3.htm.
Link Width	▪ 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) ▪ Queue link width = the width of the traveled roadway only

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	0.66	1.40	0.47
	0.7	0.80	0.88	1.08	1.20	0.90	0.71	0.80	0.89	0.78	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	0.68	0.90	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	1.50	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
	Average		0.66	Average		0.90	Average		0.80	Average		0.66	Average		0.84	Average		0.61	Average		0.72
2012	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
	0.88	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	0.51	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
	Average		0.78	Average		0.80	Average		0.76	Average		0.81	Average		0.77	Average		0.77	Average		0.73
2013	0.80	0.90	0.89	1.36	1.60	0.85	Monitor data not available						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
	Average		0.78	Average		0.78	Average			Average			Average		0.82	Average		0.88	Average		0.76
2011-2013 Avg			0.74	2011-2013 Avg		0.83	2011-2013 Avg		0.78	2011-2012 Avg		0.73	2011-2013 Avg		0.81	2011-2013 Avg		0.75	2011-2013 Avg		0.73
Overall Average (Default Value for Worst-Case Scenario Modeling)																			0.77		

**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)	60

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****.*

APPENDIX H: BACKGROUND CONCENTRATIONS

H1: Background Concentrations for Projects in Northern Virginia

H2: Background Concentrations for Projects outside Northern Virginia

APPENDIX H1: BACKGROUND CONCENTRATION FOR PROJECTS IN NORTHERN VIRGINIA

Note: The data presented in this memorandum were originally developed when jurisdictions in northern Virginia were subject to EPA conformity requirements for CO and $PM_{2.5}$. Although those requirements no longer apply, the memorandum is retained as the data presented may still be applied.

- *For CO, the data may be applied for an analysis conducted for purposes of NEPA.*
- *For $PM_{2.5}$, the data may be applied should PM2.5 conformity requirements again become applicable.*

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 $PM_{2.5}$ 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 ($PM_{2.5}$) 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[1], i.e., the Virginia portion of the DC-MD-VA maintenance area for the 1997 annual $PM_{2.5}$ National Ambient Air Quality Standard (NAAQS).
- The City of Alexandria and the County of Arlington[2], 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

1 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 $PM_{2.5}$ NAAQS: Alexandria, Arlington County, Fairfax, Fairfax County, Falls Church, Loudoun County, Manassas, Manassas Park, and Prince William County.

2 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^{nd} maximum mass concentration for the most recent two years[3]. 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[4] 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.

3 http://www.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19900618_laxton_ozone_co_design_value_calcs.pdf

4 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

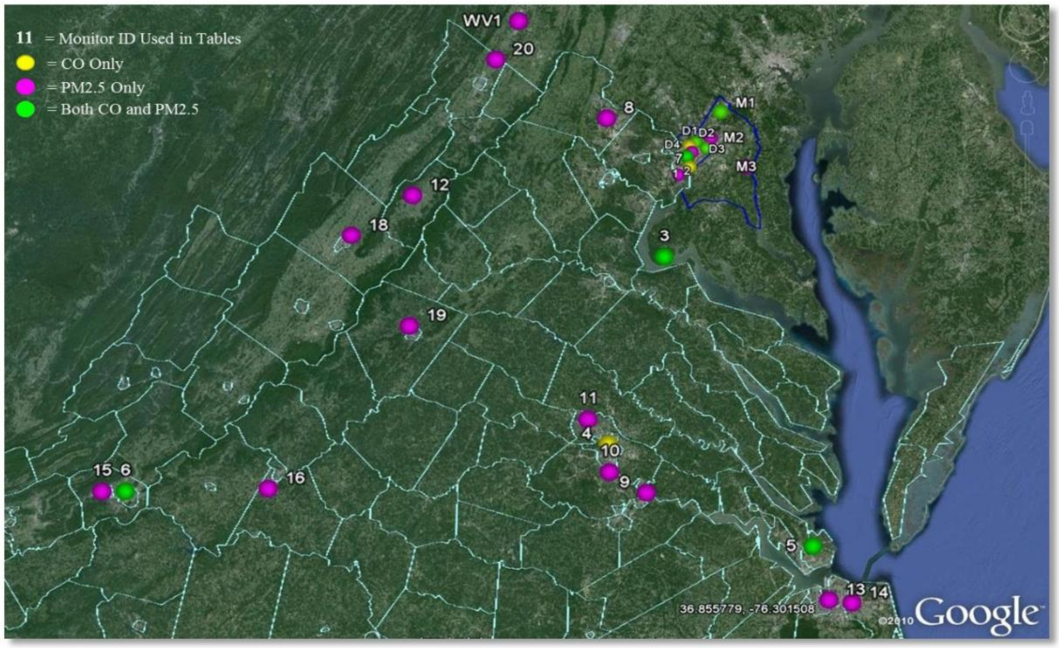


Figure 2: Monitor Locations – Northern Virginia

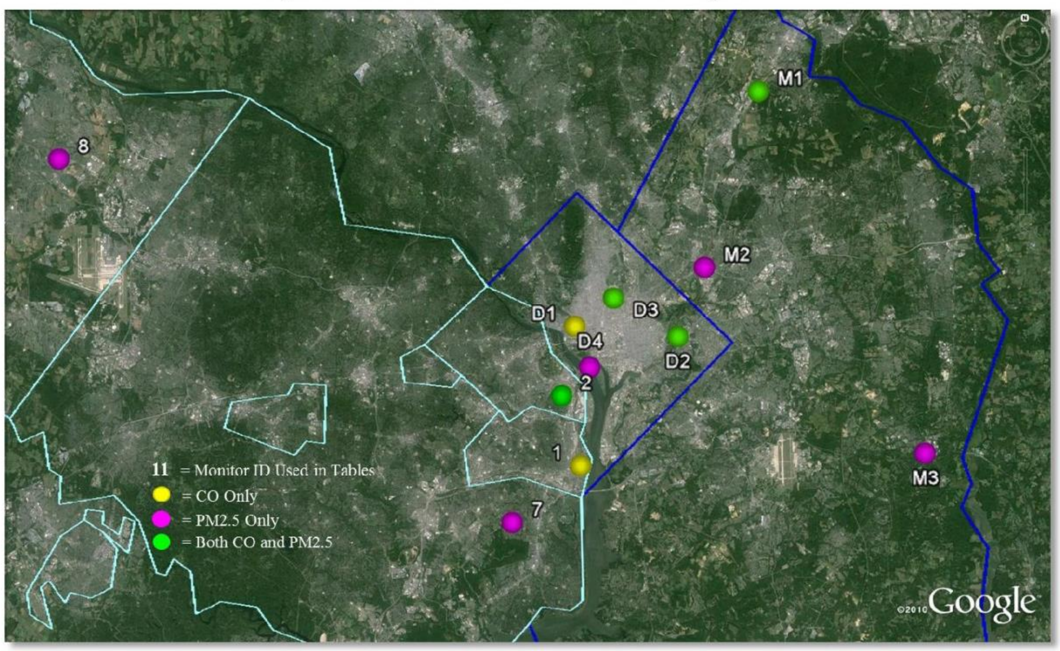


Table 1a: CO 2012-2013 Second Maximum Values for Virginia Monitors

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* 515100021*	Alexandria City	1.4	1.0
2	NOVA	510130020	Arlington	1.6	1.4
3	Richmond	510870014	Henrico	1.5	1.2
4	Richmond	517600024** 517600025**	Richmond City	2.2	1.8
5	Hampton Roads	516500008	Hampton City	1.1	0.9
5	Hampton Roads	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 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	DC	110010041	District of Columbia	2.9	2.5
D3	DC	110010043	District of Columbia	2.4	1.8
M1	MD	240330030	Prince George's	1.2	0.9

Table 2a: $PM_{2.5}$ Design Values for Virginia Monitors

2011-2013 PM2.5 Monitor Data				2011-2013 Three Year Average (µg/m3)
Site	Region	Site ID	County/City	Annual
2	NOVA	510130020	Arlington	9.4*
7	NOVA	510590030	Fairfax	8.8**
8	NOVA	511071005	Loudoun	8.9
9	Richmond	510360002	Charles	8.2
10	Richmond	510410003	Chesterfield	8.8
3	Richmond	510870014	Henrico	8.7
11	Richmond	510870015	Henrico	8.3**
5	Hampton Roads	516500008	Hampton City	7.9**
13	Hampton Roads	517100024	Norfolk City	8.7**
14	Hampton Roads	518100008	Virginia Beach City	8.5
6	Roanoke	517700015	Roanoke City	9.2
15	Roanoke	517750011	Salem City	9.1
16	Other Areas	516800015	Lynchburg City	7.8
17	Other Areas	515200006	Bristol City	9.0
18	Other Areas	511650003	Rockingham	8.9
19	Other Areas	510030001	Albemarle	7.9**
20	Other Areas	510690010	Frederick	9.5
12	Other Areas	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: $PM_{2.5}$ Design Values for DC-MD-WV Monitors

2011-2013 PM2.5 Monitor Data				2011-2013 Three Year Average (µg/m3)
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		240338003	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 $PM_{2.5}$ to be used for project-level conformity analyses in Northern Virginia. Per EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} 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 ($PM_{2.5}$)

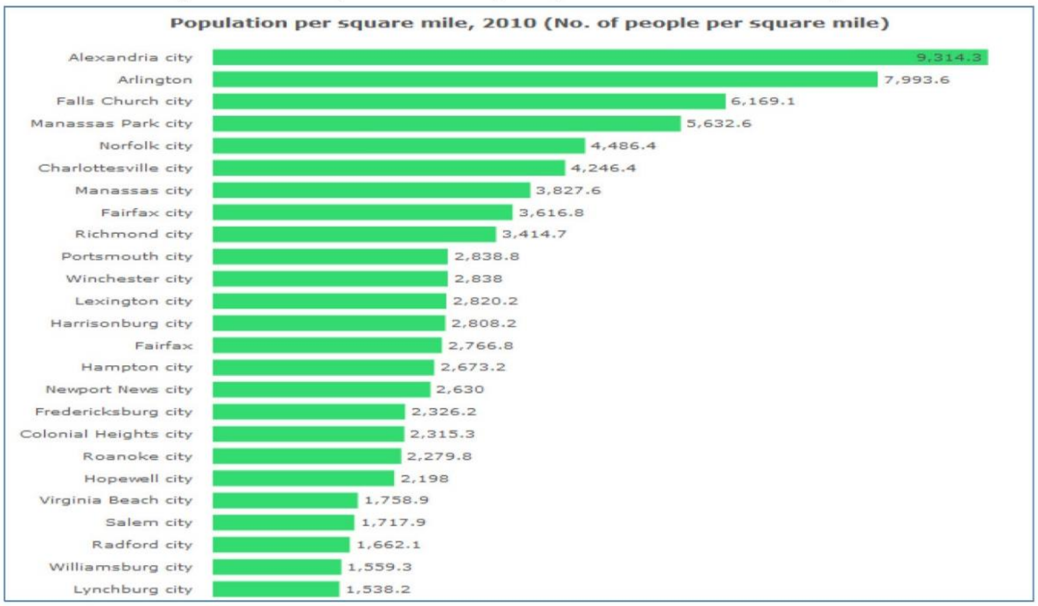
Background concentrations for $PM_{2.5}$ are needed to support project-level conformity analyses in Northern Virginia. **Table 4** summarizes the recommended default background concentrations for $PM_{2.5}$.

Table 4: Default $PM_{2.5}$ Background Concentrations for Northern Virginia

Region	Background Concentration (µg/m3)
	Annual
Arlington County & Alexandria City	9.4
Remaining Jurisdictions	8.9

A separate $PM_{2.5}$ 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 Loudon 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: BACKGROUND CONCENTRATIONS FOR PROJECTS OUTSIDE NORTHERN VIRGINIA

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[1]. 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 2nd maximum mass concentration for the

1 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 $PM_{2.5}$ 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[2]. 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[3] 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.

2 http://www.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19900618_laxton_ozone_co_design_value_calcs.pdf
3 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

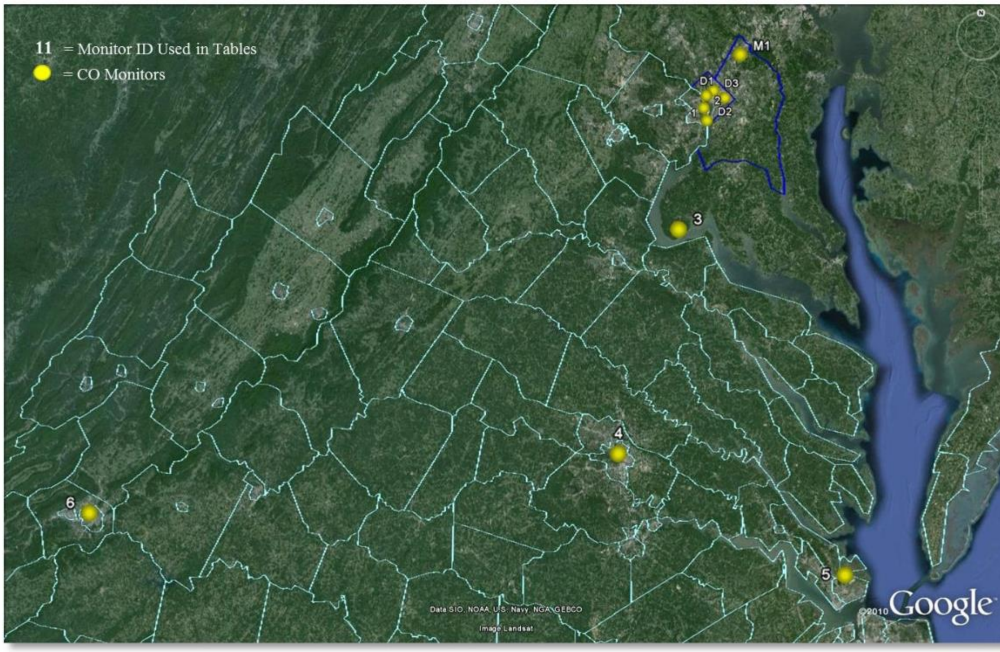


Figure 2: Monitor Locations – Northern Virginia

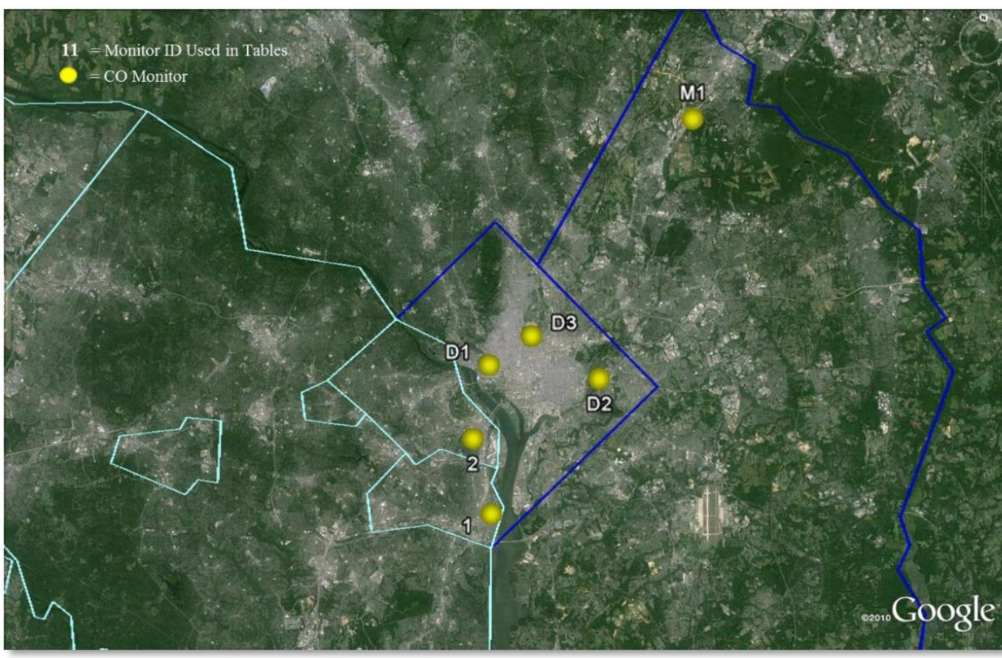


Table 1a: CO 2012-2013 Second Maximum Values for Virginia Monitors

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* 515100021*	Alexandria City	1.4	1.0
2		510130020	Arlington	1.6	1.4
3	Richmond	510870014	Henrico	1.5	1.2
4		517600024** 517600025**	Richmond City	2.2	1.8
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, Loudon 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.

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) 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	S1374387 and 93734-87 (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).	▪ Arlington County ▪ City of Alexandria ▪ Fairfax County: For project areas closer to the DCA airport
IAD	S9373886 and 93734-86 (87/88/90/91)	.DAT and .TXT		▪ Fairfax County: for project areas closer to the IAD airport ▪ Loudoun County ▪ Prince William County

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).	▪ Arlington County ▪ City of Alexandria ▪ Fairfax County (project areas closer to DCA)
IAD_STR_2009_2013	IAD_2009 (10/11/12/13)	.SFC and .PFL		▪ Fairfax County (project areas closer to IAD) ▪ Loudoun County ▪ Prince William County

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 (σ_θ) and sigma-w (σ_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[1] (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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[1] http://landcover.usgs.gov/natllandcover.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

Dulles International Airport					
Month	**2009**	**2010**	**2011**	**2012**	**2013**
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
Reagan National Airport					
Month	**2009**	**2010**	**2011**	**2012**	**2013**
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
AERMET- Last Step in Processing Raw Meteorology Data			
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)
AERMINUTE – Processes 1 minute ASOS wind data			
	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
AERSURFACE – Used to obtain surface characteristics values for AERMET			
DCA/Avg_AerSurface	AERSURFACE	.DAT	Summary of responses to program prompts
	DCA_Aersruface_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
DCA_Sfc_13743			
	724050-13743-2009 (10/11/12/13)	No file extension	Raw surface data for AERMET
1_min_2009 (10/11/12/13)	64050KDCA200901 (02-12)	.DAT	Monthly 1 minute ASOS wind data
Landuse			
	87921381	.ZIP	Zip file containing Land use .tif files for AERSURFACE
Precipitation			
	DCA_1984_2013_precipitation	.XLS	Precipitation summary for years 1984 to 2013
STR_UA_93734 (used as AERMET input)			
	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 is used for DRY_AERSURFACE and WET_AERSURFACE and 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

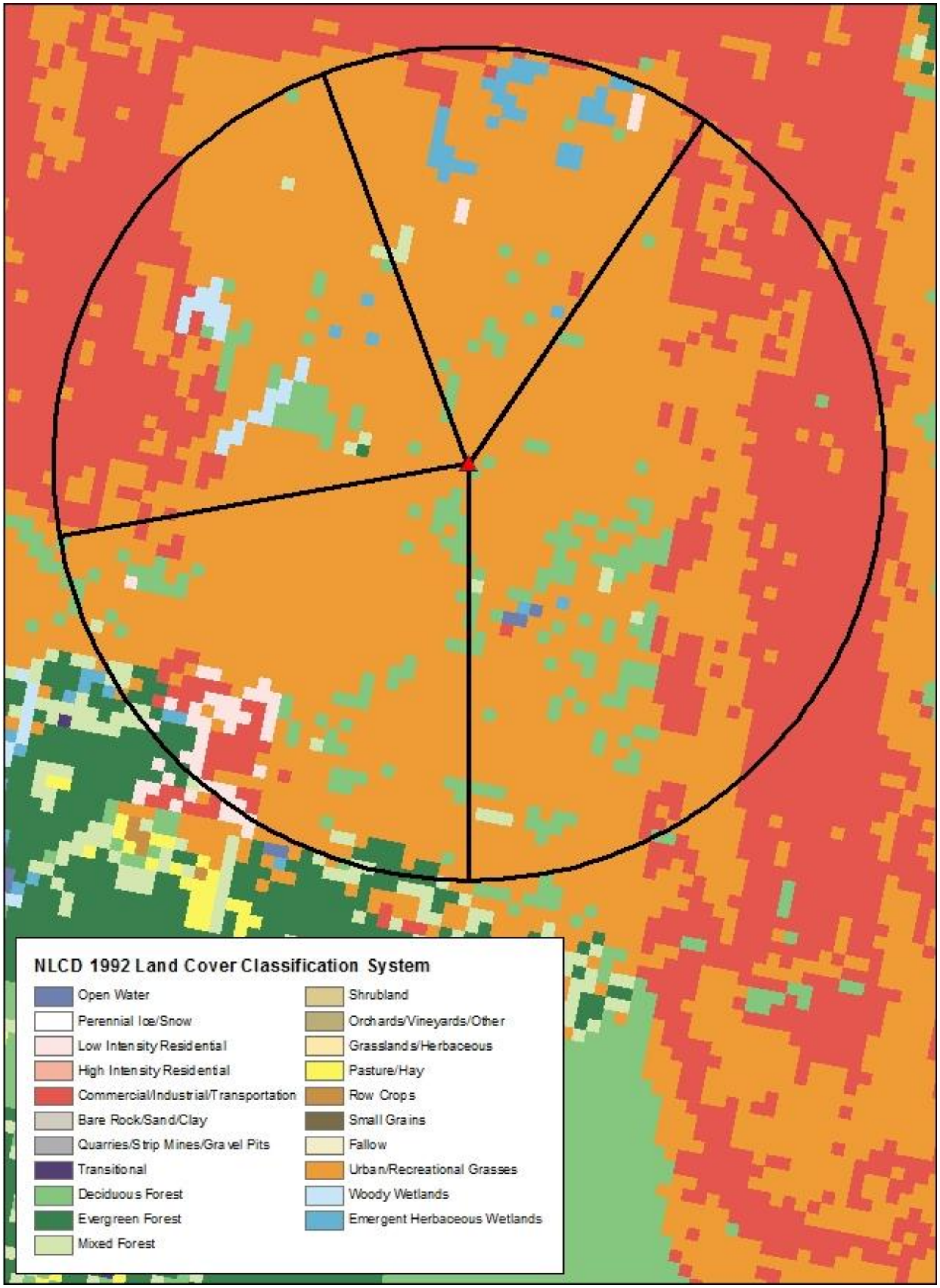


Figure 3: Sectors Used for Surface Characteristics at Reagan National Airport

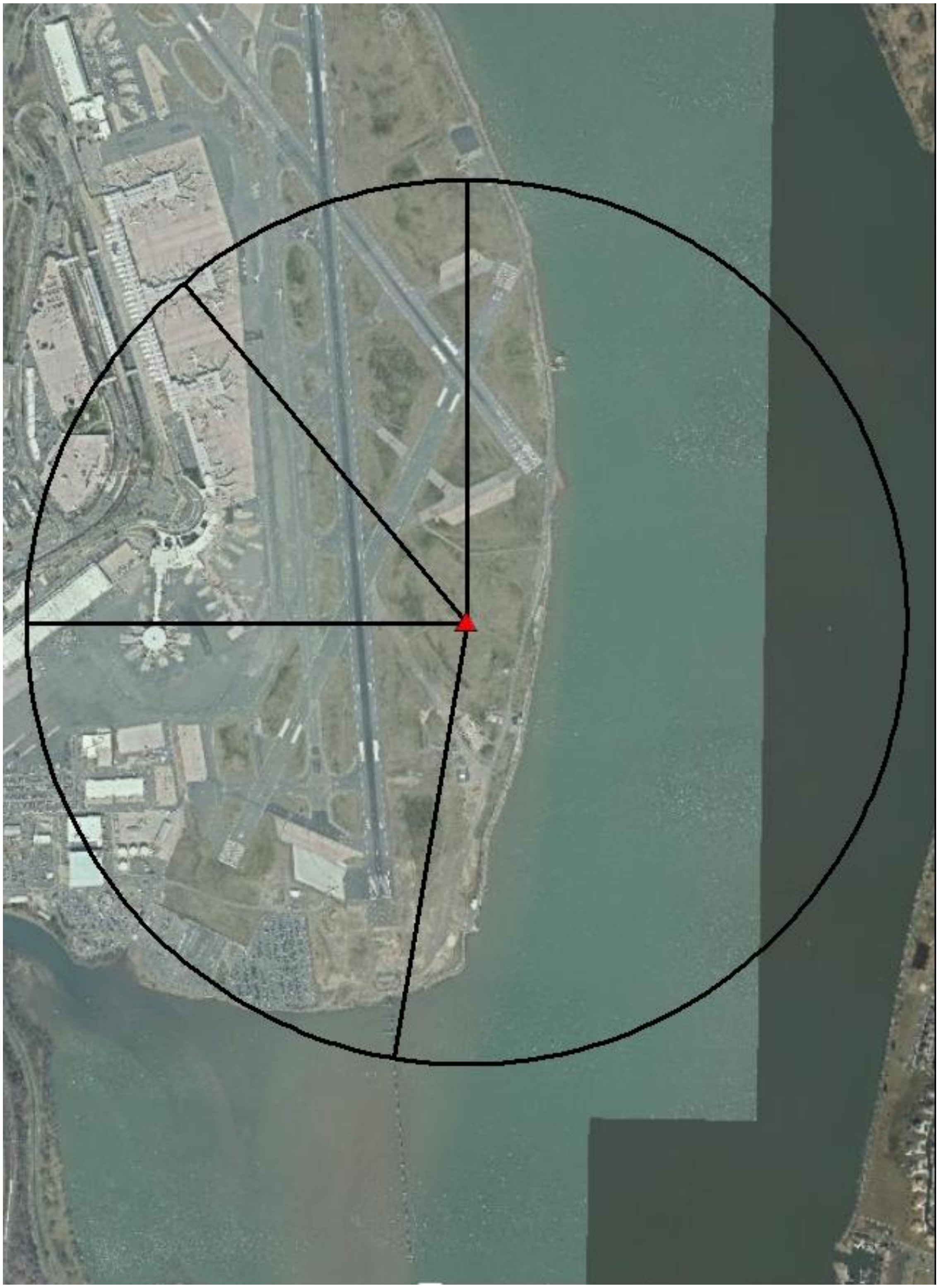
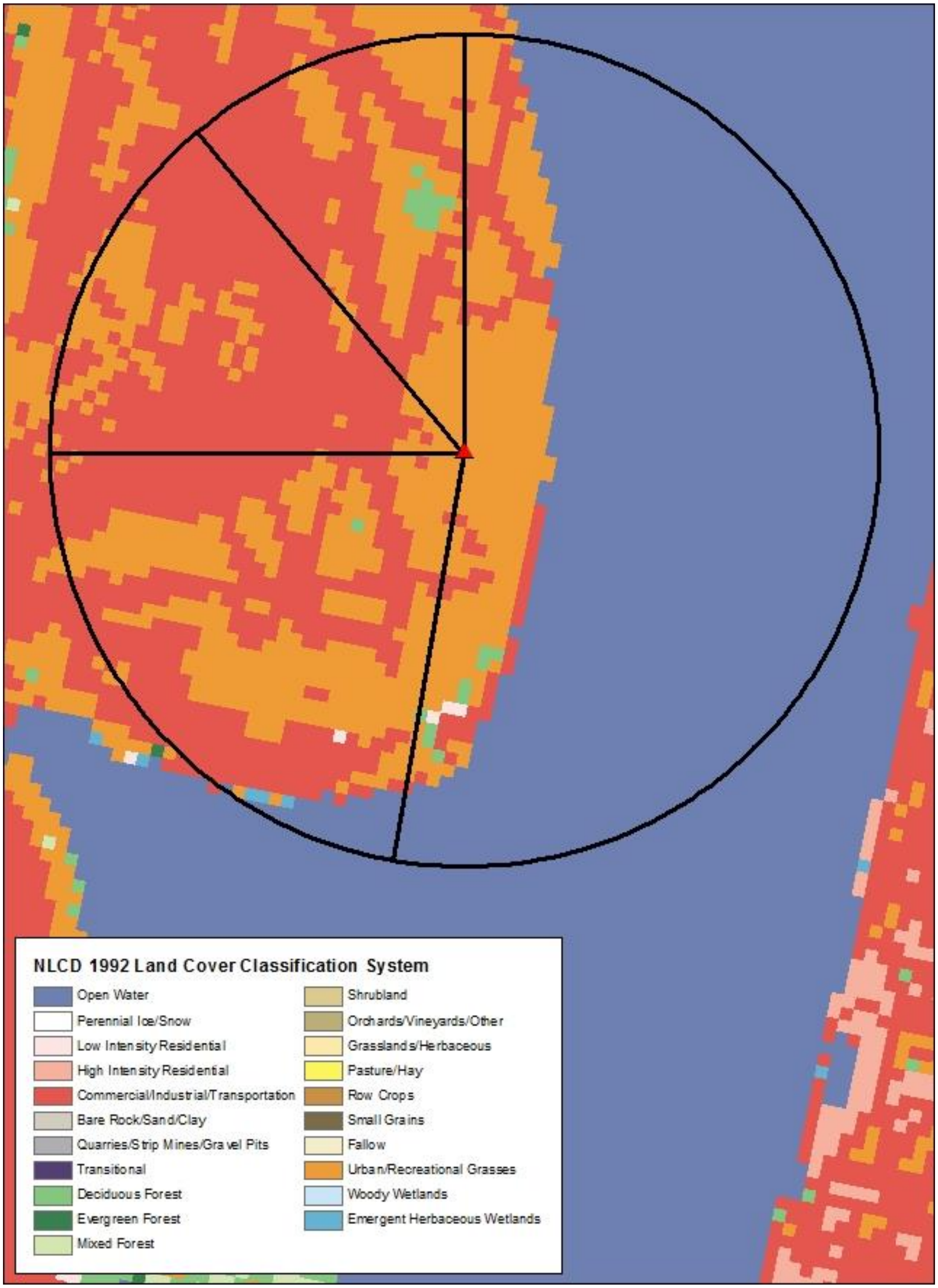


Figure 4: 1-Km Radius for Reagan National Airport with Surface Roughness Sectors Shown on Land Use Imagery



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[2] 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.

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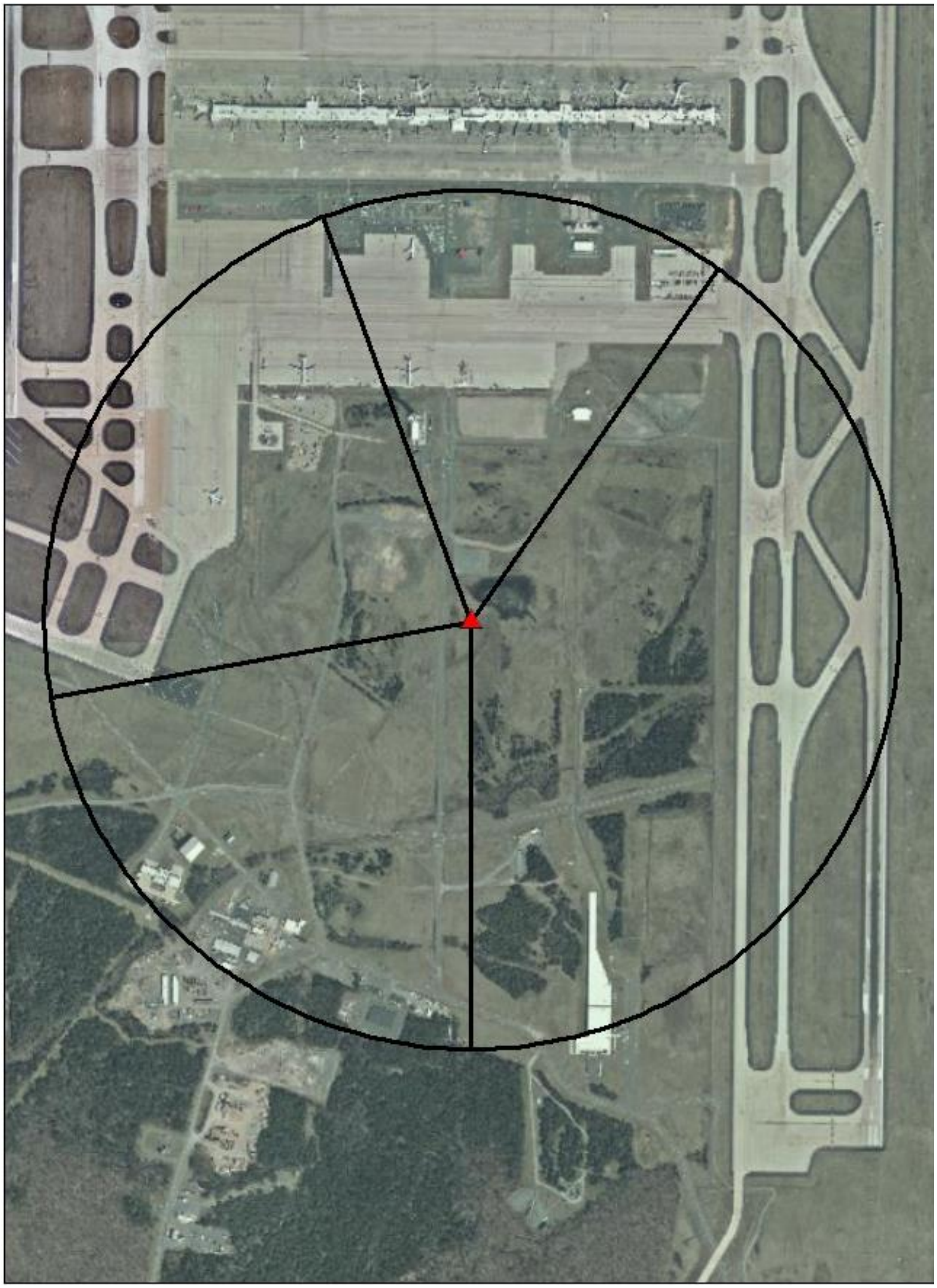
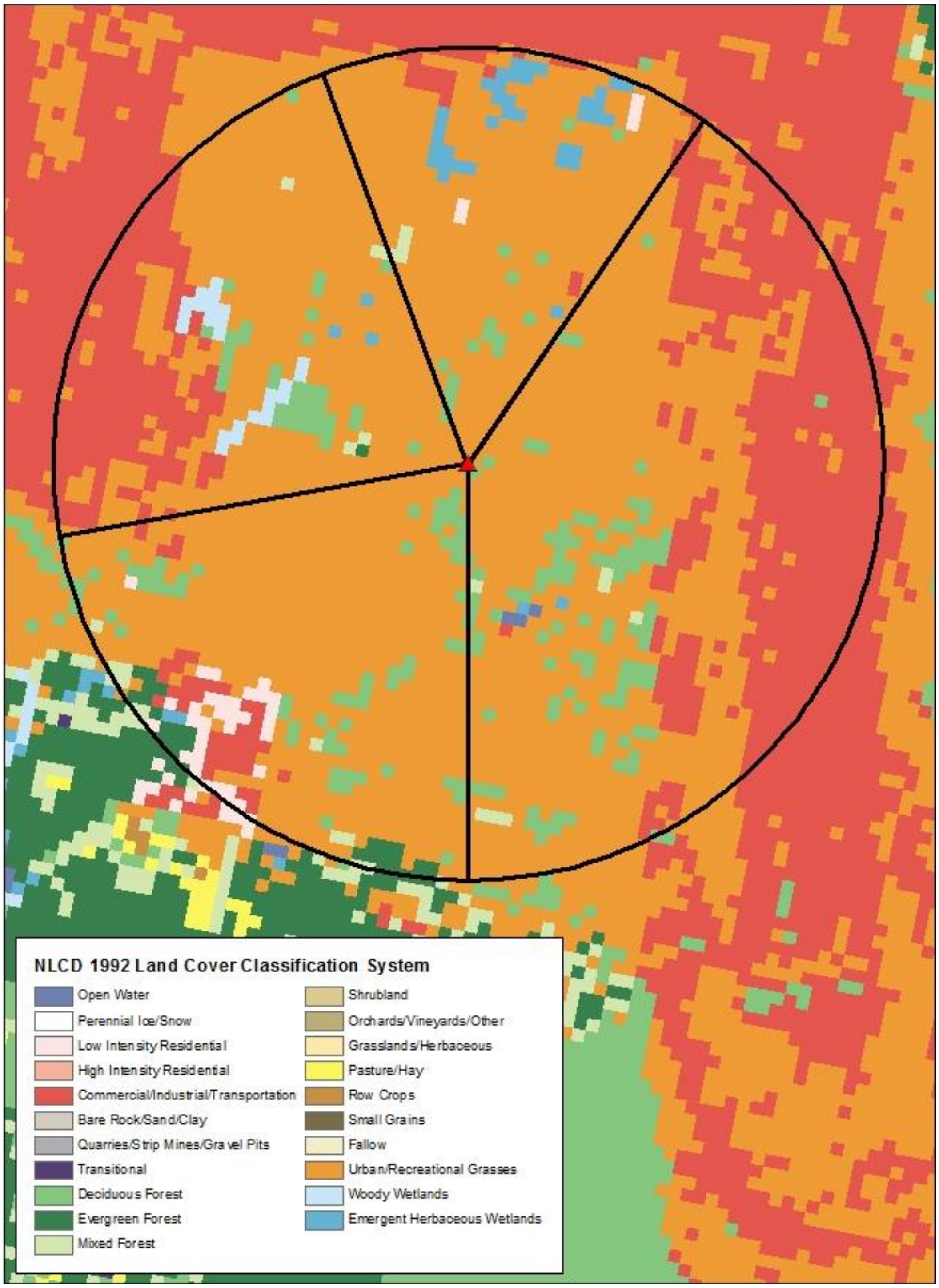
[2] The AERSURFACE citation for the grassy area surface roughness values is Table 5.4 in Randerson, D., 1984, "Atmospheric Boundary Layer," in Atmospheric Science and Power Production, ed., D. Randerson. Technical Information Center, Office of Science and Technical Information, U.S. Department of Energy, 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

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 $PM_{2.5}$ in the online data repository
- For the $PM_{2.5}$ 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, $PM_{2.5}$ and MSATS analyses are provided below:

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

```
<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>
  <onroadvehicleselections>
          <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42"
sourcetypename="Transit Bus"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetypename="Combination Long-haul
Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetypename="Combination Short-haul
Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetypename="Intercity Bus"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetypename="Light Commercial
Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetypename="Motor Home"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="11" sourcetypename="Motorcycle"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetypename="Passenger Car"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetypename="Passenger Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetypename="Refuse Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="43" sourcetypename="School Bus"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetypename="Single Unit Long-haul
Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetypename="Single Unit Short-haul
Truck"/>
          <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetypename="Transit Bus"/>
          <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="32" sourcetypename="Light Commercial
Truck"/>
          <onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="21" sourcetypename="Passenger Car"/>
```

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		<onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="31" sourcetypename="Passenger Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="41" sourcetypename="Intercity Bus"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="54" sourcetypename="Motor Home"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="11" sourcetypename="Motorcycle"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="21" sourcetypename="Passenger Car"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetypename="Passenger Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetypename="Refuse Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetypename="School Bus"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
		<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetypename="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 CO Analysis]


```
		<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="1" processname="Running Exhaust"/>
		<pollutantprocessassociation pollutantkey="2" pollutantname="Carbon Monoxide (CO)" processkey="15" processname="Crankcase Running 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" numberofrunspersimulation="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="true" truncateactivity="true" truncatebaserates="true"/>
</runspec>
```

[Sample MRS file for January AM period for $PM_{2.5}$]

```
<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" sourcetypename="Transit Bus"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetypename="Intercity Bus"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="54" sourcetypename="Motor Home"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="11" sourcetypename="Motorcycle"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="21" sourcetypename="Passenger Car"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="51" sourcetypename="Refuse Truck"/>
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<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
<onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="42" sourcetypename="Transit Bus"/>
<onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
<onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="21" sourcetypename="Passenger Car"/>
<onroadvehicleselection fueltypeid="5" fueltypedesc="Ethanol (E-85)" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="41" sourcetypename="Intercity Bus"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="32" sourcetypename="Light Commercial Truck"/>
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<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="31" sourcetypename="Passenger Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="51" sourcetypename="Refuse Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="43" sourcetypename="School Bus"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="53" sourcetypename="Single Unit Long-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="52" sourcetypename="Single Unit Short-haul Truck"/>
<onroadvehicleselection fueltypeid="1" fueltypedesc="Gasoline" sourcetypeid="42" sourcetypename="Transit Bus"/>
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<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 $PM_{2.5}$ 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" numberofrunspersimulation="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"/>    [analysis months]
        <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"/>    [include 24 hours in run]
        <aggregateBy key="Hour"/>
  </timespan>
  <onroadvehicleselections>
        <onroadvehicleselection fueltypeid="3" fueltypedesc="Compressed Natural Gas (CNG)" sourcetypeid="42" sourcetypename="Transit Bus"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="62" sourcetypename="Combination Long-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="61" sourcetypename="Combination Short-haul Truck"/>
        <onroadvehicleselection fueltypeid="2" fueltypedesc="Diesel Fuel" sourcetypeid="41" sourcetypename="Intercity Bus"/>
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</roadtypes>
<pollutantprocessassociations>
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[Below are pollutants included for $PM_{2.5}$ Analysis]


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	<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"/>
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<pollutantprocessassociation pollutantkey="183" pollutantname="Phenanthrene gas" processkey="1" processname="Running Exhaust"/>
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<pollutantprocessassociation pollutantkey="184" pollutantname="Pyrene gas" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="184" pollutantname="Pyrene gas" processkey="15" processname="Crankcase Running Exhaust"/>
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<pollutantprocessassociation pollutantkey="84" pollutantname="Pyrene particle" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="115" pollutantname="Sulfate Particulate" processkey="1" processname="Running Exhaust"/>
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		<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"/>
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  </databaseselections>
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]]></internalcontrolstrategy>
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  <geographicoutputdetail description="COUNTY"/>
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		<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=""/>
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  <outputvmtdata value="true"/>
  <outputsho value="false"/>
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  <outputshp value="false"/>
  <outputshidling value="false"/>
  <outputstarts value="false"/>
  <outputpopulation value="false"/>
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  <pmsize value="0"/>
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		<timefactors selected="true" units="Days"/>
		<distancefactors selected="true" units="Miles"/>
```

```
		<massfactors selected="true" units="Grams" energyunits="Million BTU"/>
	</outputfactors>
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	</savedata>
	<donotexecute>
	</donotexecute>
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	<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
(Incomplete Data – Shown For Format Only)			

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	**2015**	**8**	**27002**	**1**	**0.5**
1270011000	2015	9	3301	1	0.5
1270011000	**2015**	**9**	**3303**	**0**	**0.5**
1270011000	2015	9	25005	1	0.5
1270011000	**2015**	**9**	**27002**	**1**	**0.5**
1270011000	2015	10	25005	1	0.5
1270011000	**2015**	**10**	**27002**	**1**	**0.5**
1270011000	2015	11	3302	1	0.5
1270011000	**2015**	**11**	**25005**	**1**	**0.5**
1270011000	2015	11	27001	1	0.5
1270011000	**2015**	**12**	**3302**	**1**	**0.5**
1270011000	2015	12	25005	1	0.5
1270011000	**2015**	**12**	**27001**	**1**	**0.5**

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 (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	201.551	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	201.551	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	186.449	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	186.449	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)												

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' 60 175 0 0 6 0.3048 1 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]***
'Northbound Thru APP' 'AG' 207085.5 317520.2 207049.7 317450.9 1230 1.5 0 32
1
'Northbound Thru DEP' 'AG' 207090.2 317524.8 207143.5 317588.7 1230 1.3 0 32
1
'Southbound Thru APP' 'AG' 207114.5 317590.2 207085.9 317550.4 1230 1.6 0 32
1
'Southbound Thru DEP' 'AG' 207084.7 317547.7 207062.2 317511.9 1230 1.5 0 32

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

2
'Northbound Thru Queue' 'AG' 207085.5 317520.2 207049.7 317450.9 0 12 1
120 68 2 1230 3.5 1900 1 3
2
'Southbound Thru 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

****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]***

1 0 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.ilk

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.ilk

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 ***[Receptors]***
'RCP 4',732,1426.5,5
'RCP 5',1328.7,554.5,5
'RCP 6',1683.7,43,5
2,'P',
1,1,1,1,1,1,1,
'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 ***[Link Information]***
'SB Freeway Segment 1','AG',613.8,2828.4,1304.5,957.7,0,67.7

```
5,1,
'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      [Hourly traffic volume and emission factors]
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      [Hourly traffic volume and emission factors - continued]
4,1960,0.044214
5,1960,0.044214
6,2337,0.028208
```

<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 1 110  51.0000   1.5433 271.5 4  438.4  534.7
91 1 111  14.0000   2.0578 274.3 3  618.3  690.6
91 1 112 356.0000   4.6300 274.8 3  798.2  846.4
91 1 113  13.0000   3.6011 275.4 4  978.1 1002.2
91 1 114  29.0000   4.1155 276.5 3 1158.0 1158.0
91 1 115   2.0000   3.6011 276.5 4 1158.0 1158.0
91 1 116   4.0000   4.1155 277.0 4 1158.0 1158.0
91 1 117  51.0000   2.5722 274.8 5 1154.7 1139.5
91 1 118  17.0000   1.5433 272.6 6 1127.7  989.4
91 1 119 164.0000   2.0578 270.4 6 1100.8  839.4
91 1 120 307.0000   1.5433 269.8 7 1073.9  689.3
91 1 121 340.0000   1.5433 269.3 7 1046.9  539.2
91 1 122 342.0000   0.0000 268.1 7 1020.0  389.1
91 1 123 340.0000   0.0000 267.6 7  993.1  239.1
91 1 124 340.0000   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 1 210 171.0000   2.0578 272.6 4  222.9  278.2
91 1 211 185.0000   2.0578 275.4 3  314.4  355.9
91 1 212 181.0000   2.0578 277.0 3  405.9  433.6
91 1 213 189.0000   2.0578 279.3 3  497.5  511.3
91 1 214 167.0000   2.0578 281.5 3  589.0  589.0
91 1 215 170.0000   2.5722 282.0 3  589.0  589.0
91 1 216 184.0000   1.5433 282.6 3  589.0  589.0
91 1 217 158.0000   1.5433 280.4 4  586.6  586.6
91 1 218  51.0000   1.5433 276.5 5  564.6  507.3
91 1 219  22.0000   1.5433 273.1 6  542.6  433.8
91 1 220  25.0000   0.0000 272.6 7  520.6  360.2
91 1 221  24.0000   0.0000 272.0 7  498.7  286.7
91 1 222  25.0000   0.0000 271.5 7  476.7  213.1
```

```
91 1 223  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-

<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. <u>Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I2:</u>

[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-

<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 I1:

```
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 I1:

```
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 I1:

```
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 1 11 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 1 12 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 1 13 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 1 14 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 1 15 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 1 16 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 1 17 -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 1 18 -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 1 19 -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 1 20 -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 1 21 -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 1 22 -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 1 23 -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 1 24 -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.<u>**Sample file 2 – For jurisdictions using IAD airport met data as assigned in Appendix I1:**</u>

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
```

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<u>AERMOD Receptors File:</u>

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>
```

APPENDIX K: EXAMPLE MITIGATION MEASURES

K1: CO Mitigation Measures

K2: $PM_{2.5}$ 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 $PM_{2.5}$ MITIGATION MEASURES

(Related to Transportation Improvements)

Per Section 10 of EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 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. 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.
    - 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 PM2.5 or PM10 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 PM10 hot-spot analyses, since all PM10 nonattainment and maintenance areas must include these emissions in such analyses. However, there may be PM2.5 nonattainment and maintenance areas that also could take advantage of these measures if re-entrained road dust or construction dust is required for a PM2.5 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
  - 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.*

APPENDIX L: VDOT $PM_{2.5}$ PROJECT ASSESSMENT CRITERIA

$PM_{2.5}$ Project Assessment Criteria by Project Type[33]

- **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 **10,000*****?	
Yes	**No**
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 (2015) update, namely[34]: "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."*

[33] 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.
[34] See Appendix B of: *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas,* EPA-420-B-15-084, November 2015

➢ Highway Capacity Expansion*

<table>
<tr><td colspan="3">Is the <u>increase</u> in diesel AADTT (if any) for the opening year build scenario less than or equal to 20% of the criteria listed above for New Highway Construction?</td></tr>
<tr><td>Yes</td><td colspan="2">No</td></tr>
<tr><td rowspan="3">Clearly Not A Project of Air Quality Concern</td><td colspan="2">Is the opening year diesel AADTT at or below the criteria listed above for New Highway Construction?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>Clearly Not a Project of Air Quality Concern</td><td>Additional Review Required</td></tr>
</table>

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

➢ Intersections

<table>
<tr><td colspan="3">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?</td></tr>
<tr><td>Yes</td><td colspan="2">No</td></tr>
<tr><td rowspan="3">Clearly Not A Project of Air Quality Concern</td><td colspan="2">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?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>Clearly Not a Project of Air Quality Concern</td><td>Additional Review Required</td></tr>
</table>

➢ New Intermodal or Transit Facility for Rail, Bus, or Truck

<table>
<tr><td colspan="2">Is the facility not considered to be a "regionally significant project" under 40 CFR 93.101*?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>Clearly Not A Project of Air Quality Concern</td><td>Additional Review Required</td></tr>
</table>

**This criterion is based on the example of projects of air quality concern presented in EPA guidance[35]: "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

<table>
<tr><td colspan="3">Will the expanded facility have less than a 50% increase in daily diesel bus/truck arrivals or, for small facilities, a total of less than or equal to 15 diesel buses/trucks in the peak hour of that facility*?</td></tr>
<tr><td>Yes</td><td colspan="2">No</td></tr>
<tr><td rowspan="3">Clearly Not A Project of Air Quality Concern</td><td colspan="2">Does the expanded facility otherwise meet the criteria specified for New Intermodal or Transit Facilities as specified above?</td></tr>
<tr><td>Yes</td><td>No</td></tr>
<tr><td>Clearly Not a Project of Air Quality Concern</td><td>Additional Review Required</td></tr>
</table>

**These values are based on the examples presented in EPA guidance[36]:*

- *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)."*

[35] *Ibid.*
[36] *Ibid.*