

Section (8) Dispersion Modeling Protocol Instructions

According to 10 CSR 10-6.060(8) any new major stationary source or major modification to a stationary source that proposes to locate within an area that is classified as attainment or unclassifiable must obtain a Prevention of Significant Deterioration (PSD) air construction permit prior to commencing construction.

If it is determined that a facility is subject to the PSD requirements, any pollutant that exceeds the *de minimis* emissions thresholds becomes subject to review and will be required to submit an ambient air quality impact analysis. The air quality impact analysis must include a review of both the Class I and Class II areas that are affected by the proposed facility. Additional impact analyses are also required and must be submitted with the construction permit application.

All Section (8) PSD permit applicants should provide a modeling protocol to the permit granting authority prior to the completion of the modeling study. The department's dispersion modeling template should be used to outline the modeling methodologies that will be employed in the ambient air quality impact analysis. The template will aid in the development of the modeling protocol and provides a standardized set of procedures for conducting and evaluating air quality modeling studies.

The protocol template can be completed electronically or manually and should be provided to the Construction Permit Modeling Unit prior to the completion of the Section (8) ambient air quality impact analysis. Questions or comments related to the template should be directed to the staff of the Construction Permit Modeling Unit at (573)751-4817.

The following paragraphs provide a brief summary of the recommended modeling methodologies that are currently being employed by the department's Air Pollution Control Program. Please note any differences or deviations within the body of the protocol document in the appropriate section.

The template is subdivided into four categories: Installation Description, Class II Analysis, Class I Analysis and Additional Impact Analyses.

Installation Description

1. Installation & Project Description

A description of the facility operations should be included in the protocol document. Each description should be detailed enough to allow the reader to gain a basic understanding of the source and type of emissions that are likely to occur based upon the operations at the facility.

The project description should note if the facility is an existing source or a new construction and must include information regarding each emission point that is proposed. Again, the description should be detailed enough to allow the reader to gain a basic understanding of the source and type of emissions that are likely to occur and how they will impact existing source operations.

2. Installation Locational Data

The Missouri Department of Natural Resources tracks all locational information in the Universal Transverse Mercator (UTM) geographic coordinate system. Two differing UTM zones are present within the State of Missouri, Zone 15 and Zone 16. In order to provide consistency throughout the state, all locational data provided to the department will be tracked using Zone 15 coordinates.

In addition to providing the geographic coordinate system that is being employed within the ambient air quality impact analysis, the applicant must describe the geodetic reference system from which the locational data was obtained. The department employs the North American Datum 1983 (NAD83) as its default geodetic reference system. In those instances where the coordinates are expressed in NAD27, the coordinates will be converted to NAD83 using GIS tools.

Class II Analysis

Construction permit applicants are required to submit an ambient air quality impact analysis demonstrating that the new source or modification, in conjunction with existing emission sources, will not cause or contribute to a violation of an applicable National Ambient Air Quality Standard or increment standard. The Environmental Protection Agency has established recommendations for evaluating impacts within Class II areas. Each recommendation that should be addressed in the Class II protocol document has been incorporated into the instructions that follow.

1. Model Selection & Pollutants Under Review

Although each facility is unique, the methodology used to demonstrate compliance should be consistent, and at a minimum, should follow the recommendations contained within the Code of Federal Regulations, Title 40, Part 51, Appendix W, entitled "[The Guideline on Air Quality Models](#)."

The most recent version of the recommended air quality model should be used unless prior approval for the use of an alternate version or alternate model has been obtained from the department's Air Pollution Control Program. The justification must include a model performance assessment that demonstrates why the alternative model would more accurately characterize the ambient impact from the emission releases at the facility.

In addition, each pollutant under review should be noted, with emphasis placed upon any non-regulatory model options that are being considered. Typical regulatory default options include stack-tip downwash, elevated terrain effects and the implementation of calm/missing data processing routines.

2. Modeled Emission Rates & Limits

All emission estimates should be based upon the use of maximum allowable emissions or federally enforceable limits (for existing sources) contained within construction permits, operating permits or other enforceable mechanisms such as consent decrees, state requirements or federal requirements. In the absence of limits, potential to emit calculations should be used in the ambient air quality impact analysis.

Any emission limits applied to the new source or modification must be clearly described and must include a detailed account of all assumptions used in the calculation of the emission estimates, including, but not limited to, capture and control efficiency estimates. Likewise, any model assumptions made through the application of the EMISFACT keyword within the model input file, should be noted. *Any limits that are noted will become a special condition within the construction permit.*

3. Source Characterization & Facility Layout

The applicant should provide the methodology that will be used to characterize emission releases within the ambient air quality impact analysis. The following paragraphs contain the assumptions that should be used to characterize emission releases based upon source type, i.e. point, volume or area. Any deviation from the noted methodology should be described in detail with justification provided for their use. For more information regarding source characterization, please refer to the [Modeling Procedures](#) section of the Permit Modeling Guidance website.

Point Source Emission Releases

The point source algorithm should be used to model emission releases from stacks and isolated vents. Any restriction to vertical flow due to the presence of rain caps or horizontal stacks should be accounted for by reducing the exit velocity to 0.001 meters per second in the model input file. The following items should be noted for point source releases:

- Stack Type
 - Vertical Stacks with Unrestricted Air Flow
 - Horizontal stack
 - Limit Exit Velocity to 0.001 Meters Per Second
 - Vertical Stack with a Rain Cap
 - Limit Exit Velocity to 0.001 Meters Per Second
 - Vent with Fan
 - Provide Justification for Classification as a Point Source
- Stack Height
 - Height Above the Ground in Meters
- Good Engineering Practice Stack Height
- Stack Temperature
 - Degrees Kelvin
- Stack Exit Velocity
 - Meters per Second
- Stack Diameter
 - Meters

For further guidance on point source characterization, please refer to the following document: [Point Sources](#).

Volume Source Emission Releases

The volume source algorithm should be used to model fugitive emission releases, with the exception of haul roads and storage piles, which are not routed through a stack. Additionally, any

emission release vented inside an enclosed structure, without a stack, should be characterized as a volume source with release parameters equivalent to the size of the openings that allow for the escape of fugitive emissions.

It is important to note, the total building height should not be used to calculate the initial vertical dimension of emissions that vent through small openings on large structures, such as silo bin vents. The initial vertical dimension in these instances should be limited to the height of the opening as alluded to in the Environmental Protection Agency Modeling Clearinghouse memo entitled "[Building Wake Effects on Volume Sources at FMC Corporation.](#)"

The following items should be noted for volume source releases along with the calculation methodology for the assignment of the release height, initial lateral dimension and the initial vertical dimension:

- Single, Surface Based Volume Source
- Volume Source within a Structure
- Elevated Source on or Adjacent to a Building with Small Openings (silo vents)
- Elevated Source Not on or Adjacent to a Building

For further guidance on volume source characterization, please refer to the following document: [Volume Sources.](#)

Area Source Emission Releases

Emissions due to haul road traffic and outdoor storage piles should be characterized as an area source release in the model input file. All haul road releases should be modeled according to the recommended area source configuration procedures outlined in the March 2, 2012 Environmental Protection Agency report entitled "[Haul Road Workgroup Final Report Submission to EPA-OAQPS](#)" as follows:

- Top of Plume Height
 - 1.7 X Vehicle Height (default 5.1 meters)
- Release Height
 - 0.5 X Top of Plume Height (default = 2.55 meters)
- X-Dimension
 - Length of the X-Side of the Area
- Y-Dimension
 - Length of the Y-Side of the Area
- Angle
 - Orientation Angle of the Area in Meters
- Initial Lateral Dimension
 - Top of the Plume Height / 2.15 (default = 2.37 meters)

When developing the haul road route, please ensure that no gaps are present and that the road follows the path used to calculate the emissions due to haul road traffic in the construction permit application.

Outdoor storage piles should also be modeled using the area source algorithm. Wind erosion emissions may be limited to those periods with wind speeds greater than twelve miles per hour.

For further guidance on area source characterization, please refer to the following document: [Area Sources](#).

Facility Layout

A map of the immediate area surrounding the source, large enough to show all contiguous property, with correct orientation and scale, should be provided in the modeling protocol. All buildings close enough to influence downwash calculations must be drawn to scale with proposed heights, tiers and corners noted. Each emission release must be indicated on the map and denoted with a source identifier that links the model input identification to the emission point identifier that will be used in the permit application. The property boundary should be plotted with fenced areas highlighted. If applicable, any on-site areas that are determined to be ambient air must be noted.

It is understood that the facility layout and final plant design may change prior to the submittal of the final air quality analysis. The protocol document does not have to contain finalized emission source descriptions; however, it must contain a description of the type of release that may be included in the air quality analysis upon finalization of the facility design.

4. Receptor Grid & Terrain Elevations

The receptor grid developed for input into the air quality model should be resolved enough to identify the area of maximum impact from fugitive and point source releases and should encompass the full extent of the maximum impact area due to the new source or modification. Receptors should be placed at 50-meter intervals along the property boundary. Near field receptors should be located at 100-meter intervals with emphasis placed upon each area of maximum impact that is identified. As the distance from the property increases, the spacing of the outer grid should steadily become coarser; refer to the following document for additional information: [Receptor Grids, Terrain, and Locational Data](#).

National Elevation Data (NED) in the GeoTIFF format from the United States Geological Survey should be processed through the AERMAP program in order to obtain the base elevation for each receptor and source within the modeling domain. In addition, the hill height scale for each receptor should be extracted as required by the AERMOD system in order to determine terrain influences within the modeling domain.

5. Meteorological Data & Surface Characteristics

Meteorological data and an evaluation of the surface characteristics surrounding the facility site will be provided to the applicant by staff from the Construction Permit Modeling Unit. In order to process the meteorological data, the applicant must provide the UTM coordinate for the facility center in the NAD83 datum, UTM Zone 15.

6. Background Concentrations & Interactive Source Inventories

Background values and interactive source inventories for incorporation into the National Ambient Air Quality Standards and increment standard evaluations will be provided by staff from the Construction Permit Modeling Unit. Requests for background concentrations and interactive source inventories can be made at the time of protocol submittal. In order to refine the number of interactive sources that are included in the ambient air quality impact analysis, the applicant should provide an estimation of the furthest extent of the impact area on a pollutant by pollutant basis. All background concentrations will be based upon existing air quality monitoring data.

7. Pre-Construction Air Quality Monitoring

Once it is determined that a facility is subject to the Prevention of Significant Deterioration requirements, any pollutant that exceeds the significant monitoring thresholds will be required to conduct an ambient air quality monitoring study in the area of maximum impact from the new source or modification. The ambient air quality monitoring study must be conducted for a period of one year prior to the issuance of the construction permit and requires the submittal of a Quality Assurance Project Plan to the Air Quality Monitoring Unit prior to the commencement of the monitoring study, refer to following document for additional information: [Preconstruction Monitoring Requirements](#).

Class I Analysis

The Federal Land Managers (FLMs) are required to identify, and subsequently protect, air quality related values (AQRVs) in Federal Class I areas or other federal lands as deemed necessary. In 2010, the FLMs issued revised recommendations for evaluating impacts for Class I areas within the document entitled "[Federal Land Managers' Air Quality Related Values Work Group \(FLAG\) Phase I Report-Revised \(2010\)](#)." Each recommendation that should be addressed in the Class I protocol document has been incorporated into the instructions that follow.

1. Initial Screening Test

The FLAG Phase I Report indicates that the permit granting authority should notify the FLM of all applications that fall within 100-kilometers of a Class I area. In addition, notification should be provided for any "large" source that is greater than 100-kilometers from a Class I area. The document suggests that the size/distance criteria established for the visibility and deposition analyses can be used to determine if a source's emissions are great enough to potentially impact a Class I area, please refer to the FLAG Phase I report, page 18. Section 3.2 entitled "Initial Screening Criteria (New)."

2. Model Selection and Pollutants Under Review

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The most recent version of the recommended air quality model, CALPUFF, should be used unless prior approval for the use of an alternate version or alternate model has been obtained from the department's Air Pollution Control Program. The justification must include a model performance assessment that demonstrates why the alternative model would more accurately characterize the ambient impact from the emission releases at the facility.

In addition, each pollutant under review should be noted, with emphasis placed upon any non-regulatory model options that are being considered. Typical regulatory default options include stack-tip downwash, elevated terrain effects and the implementation of calm/missing data processing routines.

3. Modeled Emission Rates & Limits

All emission estimates should be based upon the use of maximum allowable emissions or federally enforceable limits (for existing sources) contained within construction permits, operating permits or other enforceable mechanisms such as consent degrees, state requirements or federal requirements. In the absence of limits, potential to emit calculations should be used in the ambient air quality impact analysis.

Any emission limits applied to the new source or modification must be clearly described and must include a detailed account of all assumptions used in the calculation of the emission estimates, including, but not limited to, capture and control efficiency estimates. Likewise, any model assumptions made through the application of the EMISFACT keyword within the model input file, should be noted. *Any limits that are noted will become a special condition within the construction permit.*

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It is important to note, the total building height should not be used to calculate the initial vertical dimension of emissions that vent through small openings on large structures, such as silo bin vents. The initial vertical dimension in these instances should be limited to the height of the opening as alluded to in the Environmental Protection Agency Modeling Clearinghouse memo entitled “[Building Wake Effects on Volume Sources at FMC Corporation](#).”

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Outdoor storage piles should also be modeled using the area source algorithm. Wind erosion emissions may be limited to those periods with wind speeds greater than twelve miles per hour.

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It is understood that the facility layout and final plant design may change prior to the submittal of the final air quality analysis. The protocol document does not have to contain finalized emission source descriptions; however, it must contain a description of the type of release that may be included in the air quality analysis upon finalization of the facility design.

5. Compliance with the Increment and National Ambient Air Quality Standards

Permit applicants are required to determine compliance with the increment and National Ambient Air Quality Standards within each Class I area that could be impacted by the new source or modification, refer to the following document: [Class I Increment](#).

6. Visibility Assessment

In the 2010 revision to the FLAG Phase I report, the FLMs describe two differing approaches for evaluating visibility impacts within Class I areas based upon the distance of the facility from the area in question. Facilities located within 50-kilometers are considered to have near-field impacts where the plume(s) is compared to a viewing background. Facilities located at a distance in excess of 50-kilometers will undergo a distant/multi-source modeling analysis that includes an evaluation of the effects that multiple plumes and plume aggregation will have on the appearance of a scene.

Depending on the Class I areas under review, both a near field and a distant/multi-source study may be required, refer to the following document: [Visibility Impairment](#).

Since the near field assessments rely on contrast and the color difference index of the plume in relation to the viewing background, the FLMs have suggested that the near field assessments be conducted using VISCREEN and PLUVUE II. Three differing levels for the near-field analysis are allowed under the FLAG Phase I report: Level I Screening Analysis, Level II Screening Analysis and a Level III Refined Screening Analysis. If a near-field assessment is being conducted, describe the proposed level of analysis that is anticipated for use in the Class I analysis.

If a distant/multi-source analysis is being conducted, the FLMs recommend the use of the CALPUFF modeling system. It should be noted that the visibility assessments for the near-field and distant/multi-source evaluations must consider the annual average natural conditions. Each protocol document should provide a description of how natural visibility conditions will be quantified. The procedures outlined on Pages 26 and 27 of the FLAG Phase I report should be used.

7. Nitrogen and Sulfur Deposition

Permit applicants are required to calculate the total amount of sulfur and nitrogen deposition that will occur due to the construction of the new source or modification. The FLM has developed deposition analysis thresholds for use as screening levels below which pollutant impacts are considered negligible, please refer to the following document: [Nitrogen and Sulfur Deposition](#).

8. Receptor Grid & Terrain Elevations

The FLMs maintain a database of receptors for each Class I area located in the United States. Permit applicants can download the Class I receptor files from the following location: [Class I Receptors](#).

9. Meteorological Data & Surface Characteristics

Meteorological data will be provided to the applicant by staff from the Construction Permit Modeling Unit. In order to process the meteorological data, the applicant must provide the UTM coordinate for the facility center in the NAD83 datum, UTM Zone 15. For more information on meteorological data, please refer to the following document: [Meteorological Data and CALMET](#).

10. Interactive Source Inventories for Cumulative Impact Assessments

Background values and interactive source inventories for incorporation into the National Ambient Air Quality Standards, increment standard evaluations, visibility impairment assessments and the deposition analyses will be provided by staff from the Construction Permit Modeling Unit. Requests for background concentrations and interactive source inventories can be made at the time of protocol submittal. All background concentrations will be based upon existing air quality monitoring data.

Additional Impact Analyses

In addition to performing an ambient air quality impact analysis, all PSD applicants must evaluate the impact the new source or modification will have on growth, soils, vegetation and visibility impairment.

1. Growth

Based upon draft guidance from the Environmental Protection Agency, the growth analysis should address the growth that comes about as the result of the proposed facility. This assessment should include an evaluation of air quality impacts related to any construction, commercial, industrial, or other growth that occurs. Current growth estimates from the region for both direct and indirect impacts should be evaluated, refer to the following document: [Growth Analysis](#).

2. Soils and Vegetation Analysis

The requirement to address the impact that a new source or modification will have on local vegetative and animal species can be found in 40 CFR 52.21(o). The maximum ambient concentrations emitted by a facility must be assessed in order to ensure that adverse impacts do not occur on plants, soils, and animals. The document entitled "[A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals](#)" outlines the procedures and screening levels that are to be used in the air quality assessment.

The screening procedure document provides a seven-step process for estimating the impact from the new source or modification and begins by directly comparing pollutant concentrations to screening thresholds. The process also addresses annual soil deposition and the subsequent uptake of pollutants by plants and animals. For additional information, please refer to the following document: [Soils and Vegetation Analysis](#).

3. Class II Visibility Impairment

The PSD regulations require the applicant to provide an assessment of the plume visual impact that is likely to occur due to the proposed new source or modification. This analysis is based upon impacts within the significant impact area of the new source or modification and is separate from the Class I analysis that was described earlier within the checklist.

Initially, it must be determined what, if any, scenic vistas, airports, or other sensitive areas are located within the significant impact area of the new source or modification. Since the near field assessments rely on contrast and the color difference index of the plume in relation to the viewing background, the Environmental Protection Agency has suggested that near field assessments be conducted using VISCREEN and PLUVUE II. Please describe the proposed level of analysis that is anticipated for use in the Class II analysis. Additional information on the Class II visibility assessment can be found within the following document: [Class II Visibility Assessment](#).