

QUARRY GUIDANCE for Refined Modeling

INTRO:

The Director of the Division of Air Quality of North Carolina has instructed that all new quarries and existing quarries proposing modifications to the primary crusher will be required to submit dispersion modeling to demonstrate compliance with the National Ambient Air Quality Standards (NAAQS). Primary crusher modifications are those that increase the capability of that unit to produce comparable size and quality material. This guidance provides the Division's expectations for the modeling submitted. Assuming that the quarry is a non-PSD facility, no increment modeling will be required.

MODELS:

AERMOD is the preferred model. The use of deposition modeling is approved. Other models may possibly be used on a case-by-case basis, but should be approved beforehand by the Air Quality Analysis Branch (AQAB).

METEOROLGY:

AQAB preprocessed AERMOD meteorology is preferred and is available from the AQAB website (<http://daq.state.nc.us/permits/mets/metdata.shtml>). Other datasets (user produced) may be used on a preapproved case-by-case basis.

BACKGROUND:

For PM10, a background concentration from the nearest or most representative monitor must be added to the modeled impact concentrations. Contact AQAB for specific values. TSP modeling does not require a background to be added.

EMISSION SOURCES:

Typical sources will include crushers, screens, conveyor dumps, truck dumps, open pit, and haul roads. Although the primary pollutant of concern is PM10, both PM10 (24 hr period only) and TSP (particles 100 microns and smaller - 24 hr and annual periods) emissions are required to be modeled.

- **Production Sources.** Elevated sources like crushers should be treated as elevated volume sources. Typically, these sources, being suspended in metal girder-framed towers, are elevated volume sources not on or adjacent to a building. Release height should be the center of the actual area where the emissions are puffing out. Unless an alternative can be shown to be more conservative, each source (i.e. crusher, screen) should be treated as an independent volume source with separate parameters and emission rates. A case specific judgment must be made to arrive at the lateral side and vertical height of the volume sources. The dimensions should be based on the solid portion of the equipment as opposed to the support girder structure's dimensions. Conveyors are modeled only at the dumps from one conveyor to another or from a conveyor to a pile. The lateral dimensions used in the sigma calculations should be based on the width of the conveyer belt (slightly larger), not on the length. The vertical dimension used for sigma z calculations should be about the drop distance from belt-to-belt or belt-to-pile.

- **Open Pit.** The open pit source can be used under certain restrictions. A pit should be a walled pit, fully enclosed on all sides to accommodate the settling of particles assumed in the algorithm. If a quarry is new and the pit does not yet exist, the parameters for the modeling can be based on the depth and size of the pit at the point where the first production rock is expected to be obtained. Parameters may not be based on an expected operational size at some future date.

- **Haul Roads.** Haul roads are paved and unpaved roads used by the haul trucks to transport quarry material anywhere onsite and should be represented as a series of volume sources based on the haul truck dimensions. All haul roads should be modeled and include customer, production, and process haul roads. Truck dimensions should be provided. The guidance below is acceptable for haul road modeling in NC.
 - Volume Step 1: Determine the adjusted width of the “road”. The adjusted width is the actual width of the trucks plus 6 m. The additional width represents turbulence caused by the vehicle as it moves along the road. This width will represent a side of the base of the volume.
 - Volume Step 2: Determine the number of volume sources, N. Divide the length of the road by the adjusted width. The result is the maximum number of volume sources that could be used to represent the road.
 - Volume Step 3: Determine the height of the volume. The height will be equal to twice the height of the vehicle generating the emissions, round to the nearest meter.
 - Volume Step 4: Determine the initial horizontal sigma for each volume. Typically, this would be calculated by dividing the adjusted width by 2.15.
 - Volume Step 5: Determine the initial vertical sigma. Divide the height of the volume determined in Step 3 by 2.15.
 - Volume Step 6: Determine the release point. Divide the height of the volume by two. This point is in the center of the volume.
 - Volume Step 7: Determine the emission rate for each volume used to calculate the initial horizontal sigma in Step 4. Divide the total emission rate equally among the individual volumes used to represent the road, unless there is a known spatial variation in emissions.
 - Volume Step 8: Determine the UTM coordinate for the release point. The release point location is in the center of the base of the volume. This location must be at least one meter from the nearest receptor.

- **Storage Piles.** Storage piles must be modeled as emitting 8,760 hours per year as a volume source. If truck and conveyor dump activity cause a significant differentiation in emission rates for the piles, then a particular pile could be either broken down with time specific emission rates or treated as two separate collocated sources with the wind caused emissions being the only one emitting 8,760 hours per year. As with all sources, the permit engineer would have to approve the emission rates used.

MODEL OPTIONS AND TECHNIQUES:

Receptors must be placed, starting at the facility property lines at a density of at least 100 m on the property line, near the facility, and surrounding the modeled maximum-impact, and should extend far enough to ensure the maximum impact has been identified for each pollutant and averaging period modeled. Since quarry model run-times are quite large (large number of volume sources) and maximum impacts occur immediately at the property lines, receptors do not normally need to extend beyond 300 m from the property lines.

Dry deposition modeling is approved for quarries. We have adopted, as default, the use of unity density (1 g/cm³) and aerodynamic diameters when performing particulate modeling using the dry deposition modeling option. The following PM10 and TSP parameters should be used:

- PM10: particle density - 1 g/cm³ / aerodynamic diameter - 7.9 microns
- TSP: particle density - 1 g/cm³ / aerodynamic diameter – 79 microns

When modeling TSP, particle size distribution for the PM10 size range is not necessary; i.e., 79 microns can be used to represent all particles from 0 to 100 microns for TSP.

ANALYSIS PACKAGE:

An analysis submitted to AQAB will include at a minimum:

- A detailed, accurate map of the quarry site to include haul roads, location and footprint of all crushers, screens, conveyers, pit area, storage piles, and any other sources. Elevation contours are needed on the map, onsite and at least to the property boundaries.
- A certified plat map or surveyor's map is required as with all modeling.
- Input and output files via electronic medium.
- Any parameters used in special modeling such as processing of met data and deposition parameters.
- Results should be displayed in a table that shows the modeled impact, background concentration, and the sum total. As a reminder, the modeled PM10 (24hr) impact is the H6H over the entire 5-year met dataset. TSP is H2H over each year independently for the 24 hr period, and H1H for the annual period. The PM10 24 hr NAAQS is 150 ug/m³; the TSP SAAQS is 150 ug/m³ for the 24 hr period and 75 ug/m³ for the annual period.