MODELING PROTOCOL

The attached example modeling protocol can be used to develop the requested SO_2 modeling protocol to define the modeling methodology and assumptions to be used in evaluating your facility SO_2 impacts to compare to the new SO_2 one hour NAAQS and to determine your facility impacts at the New Hanover SO_2 monitor. A detailed modeling plan gives the DAQ/AQAB the opportunity to review and comment on the proposed modeling methodology before the analysis is begun and ensures that the modeling analysis will provide an accurate assessment of your facility impacts.

Although the example modeling protocol was developed for a specific NC Air Toxics permitting activity, the general format and content can be used to develop your SO_2 modeling protocol. In addition, the "Guidelines for Evaluating the Air Quality Impacts of Toxic Pollutants in North Carolina", available from the DAQ/AQAB web page, http://daq.state.nc.us/permits/mets/Guidance.pdf , can also be used to provide guidance and a more detailed discussion of the modeling protocol requirements. The following is a list of general suggested topics and includes specific requirements/comments, as necessary, associated with this SO_2modeling effort.

a. proposed model(s) and non regulatory options (if any); *AERMOD in full regulatory mode should be used.*
b. modeling methodology;
c. meteorology; *5 years (1988-1992) Wilmington, NC surface meteorology, and Charleston, SC upper air meteorology - available from the DAQ/AQAB web site;*
d. receptor network; *full polar/Cartesian grid beginning at the facility fenceline and extending outwards in sufficient density to locate the maximum 1-hr SO_2 impacts; Note: a 2nd model run with one receptor will also be required to determine facility maximum SO_2 impacts at the New Hanover SO_2 monitor (Longitude = 77.9565138, Latitude = 34.2684388);*
e. terrain; *elevations should be incorporated;*
f. SO_2 emission sources, source emission rates;

also note:

g. Off-site sources **should not** be included;

h. Background SO_2 concentrations **should not** be included.

If you have any questions in the development of the requested SO_2 modeling protocol, please contact Tom Anderson at (919) 715-6263, <Tom.Anderson@ncdenr.gov> or Jim Roller at (919) 715-6262 or <Jim.Roller@ncdenr.gov>.

[redacted]

March 23, 2010

Jim Roller
North Carolina Department of Environment and Natural Resources
Division of Air Quality
2728 Capital Boulevard
Raleigh, North Carolina 27604

RE: MODELING PROTOCOL FOR EVALUATING IMPACTS OF TOXIC POLLUTANTS [redacted] – MONROE, NORTH CAROLINA

Dear Jim:

[redacted]. has been requested to perform a dispersion modeling assessment of potential maximum trichloroethylene (TCE) impacts resulting from emissions at the [redacted] Inc. facility located at [redacted] in Monroe, North Carolina. TCE is used in a vapor degreaser at the facility and evaporation of TCE from the degreaser equipment results in emissions to ambient air through an associated ventilation system.

This modeling protocol provides the information requested in Section 2.0 of the *Guidelines for Evaluating the Air Quality Impacts of Toxic Pollutants in North Carolina* published by the Division of Air Quality (DAQ) in December 2009.

Facility Overview and Site Maps

The [redacted] facility transforms revert (excess alloy material arising from high performance component manufacture, from decommissioned parts and the melting process) through rigorous processing, into material that can be re-melted to produce new nickel alloys.

Pertinent to TCE emissions, nickel alloy turnings are cleaned using a TCE vapor degreaser. Turnings are introduced into an enclosed unit where they are passed through a TCE vapor zone along a vibrating track. The chips move through and above the initial vapor zone into the super heated vapor zone where any residual TCE is flashed from the chip surface and thereby the chips are dried before exiting the unit to be containerized. TCE vapors are collected from the system and routed to a carbon adsorption unit where the majority of the TCE is captured and recovered. The cleaned exhaust, containing low concentrations of TCE, is routed to the atmosphere.

A survey plot of the facility and property boundary is provided in Figure 1. This figure also denotes the location of the single TCE exhaust stack. Figure 2 provides the facility buildings and property boundary, the heights of the building tiers above ground level, and the location of the facility in Universal Transverse Mercator coordinate space (NAD 83 datum). Figure 3 provides an aerial view of the facility and the surrounding area.

[redacted]
Tel: [redacted] Fax: [redacted]
[redacted]: Operations in Africa, Asia, Australasia, Europe, North America and South America

TCE Emission Source Parameters

TCE emissions result from the use of the vapor degreaser system at the [redacted] facility as described above.

After passing through the carbon adsorption emission control system, residual TCE emissions from the degreaser system are vented to atmosphere through a 14 inch diameter exhaust stack which vents seven feet above the roof height at the location shown in Figure 1 (the roof height at this location is approximately 18 feet above ground level).

The TCE emission stack exhausts horizontally to prevent precipitation from entering the stack. Therefore, recent guidance from the U.S. Environmental Protection Agency (EPA) for capped and horizontal stacks will be utilized when representing this source in the dispersion model.[1] Because this stack will be subject to building downwash, the EPA guidance suggests that the source be modeled at its actual release height and diameter, with a nominally low exit velocity (e.g. 0.001 meters per second).

Therefore, the recommended emission release parameters for use in the dispersion model are as provided in Table 1 below.

Table 1. TCE Exhaust Stack Release Parameters for Modeling

Model Release Parameter	Parameter Value
Release Height	25 feet
Release Diameter	14 inches
Release Velocity	0.001 meters per second
Release Temperature	100 °F

The TCE emission rates to be modeled will be based on historical facility purchase and disposal records under the assumption that remaining TCE contained in materials purchased for use in the vapor degreaser during a given year are emitted through the associated exhaust stack (i.e. based on a mass balance approach).

Building downwash effects will be assessed by including direction-specific building parameters generated by the U.S. EPA Building Profile Input Program (BPIP, version 04274) incorporating the Plume Rise Model Enhancements (PRIME) algorithms. Actual estimated building dimensions for the facility will be entered into the BPIP software to generate the necessary parameters. No offsite building structures are sufficiently close to the exhaust stack to influence the downwash parameters.[2] Good Engineering Practice issues will be addressed by the BPIP software; since the

[1] *AERMOD Implementation Guide*, AERMOD Implementation Workgroup, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina, Last Revised: March 19, 2009.

[2] Only buildings within 5L of the exhaust stack, where L is the lesser of the building height or projected width, are considered in the BPIP software to influence downwash of emissions.

[redacted]

stack is less than 65 meters in height, U.S. EPA guidance suggests that actual stack height is appropriately used in the modeling assessment.[3]

Model Selection and Settings

The U.S. EPA AERMOD dispersion model (version 09292) will be used for this assessment. This is the current EPA-approved steady-state dispersion model for determining near-field impacts from industrial emission sources.

The model will be run with Rural dispersion coefficients. Although a formal land-cover analysis has not been performed for the site, visual observation of aerial photos indicates that by far the majority of the land cover is rural (e.g. forested, agricultural, and grass land). In addition, rural dispersion coefficients are considered to be conservative (resulting in higher predicted concentrations) relative to Urban dispersion coefficients, so this is a conservative approach to the modeling.

The AERMOD model considers building downwash cavity effects; therefore no separate cavity analysis will be performed.

Meteorological Data

Five years of meteorological data collected from monitoring locations in Charlotte, North Carolina (surface) and Greensboro, North Carolina (upper air) will be used for this assessment (1991 – 1995). These data are available from the DAQ website[4] and are pre-processed for the AERMOD model using the U.S. EPA AERMET program (version 06341).

These are the meteorological data sets recommended by DAQ for dispersion modeling in Union County, where the [redacted] facility is located. A wind rose showing the distribution of wind directions and wind speeds in the five year surface meteorological data set is shown in Figure 4.

The base elevation of the Charlotte surface monitoring site is 221.9 meters, which will be input to the AERMOD model.

Receptor Grid and Terrain Elevations

Discrete model receptors will be placed along the property boundary for the facility at 25 meter intervals. A regular grid of model receptors will be placed outside of the facility property boundary with 100 meter spacing in both the east-west and north-south directions. The model receptor grid will extend out a minimum of 1000 meters from the facility property boundary in all directions. Initial modeling results will be examined to confirm that the grid is sufficiently large to capture all areas of highest predicted concentration. Given that TCE emissions exhaust only seven feet above roof height on a relatively large building, and will be modeled with a nominal vertical exhaust velocity of 0.001 meters per second (i.e. will be subject to building downwash), it is expected that maximum predicted ambient concentrations will occur on or near the property boundary.

---

[3] *Guideline for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations) (Revised)*, U.S. Environmental Protection Agency, EPA-450/4-80-023R, June 1985.

[4] http://daq.state.nc.us/permits/mets/metdata.shtml accessed on March 16, 2010.

As shown in Figure 3, there is a residential trailer park located southwest of the facility. A regular grid of model receptors with 25 meter spacing will be placed over the portion of the trailer park closest to the TCE exhaust stack.

Terrain elevation data for the modeled area will be obtained from U.S. Geological Survey (USGS) National Elevation Dataset at the highest resolution available for this location from the USGS Seamless Server. These data will be used to evaluate the base heights of all sources, buildings, and receptors in the model.

The U.S. EPA AERMAP program (version 09040) will be used to determine hill-height scaling factors for each model receptor.

A plot showing the proposed model receptor locations and terrain elevation contours for the area containing model receptors is provided in Figure 5.

Assessment

The dispersion modeling methodology and input data described above will be used to estimate maximum annual average TCE concentrations over the set of model receptors for each of the five meteorological years. These results will be compared to the toxic air pollutant guideline concentration provided in 15A NCAC 02D.1104 for TCE of 59 $\mu g/m^3$.

Please review the contents of this modeling protocol and provide feedback as to its adequacy for performing the desired TCE assessment. I can be contacted by phone at [redacted] or by email at [redacted] if you have any questions or comments. Thanks in advance for your time reviewing this.

Sincerely,

[redacted] INC.

[redacted]

Associate and Senior Consultant

Received
MAR 25 2010
Air Permits Section

cc: [redacted]

BCP/BCP

Golder Associates