Suggestions for Auditing Risk Assessment Air Modeling Studies following the 1998 U.S. EPA Office of Solid Waste Human Health and Ecological Risk Assessment Protocols

U.S. EPA Region 6 Center for Combustion Science and Engineering

Provided By:

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1. Meteorological Data Pre-Processing (PCRAMMET)

- Require submittal via magnetic media (3.5" diskette) of all meteorological input (i.e., raw met files from SAMSON CD-ROM or from SCRAM bulletin board with supplemental National Climate Data Center (NCDC) precipitation data) and PCRAMMET output and log files.

- Make sure the surface and upper air met stations chosen are representative of the study site. Consult with the state air modeling specialist (or meteorologist) to confirm the representativeness of the upper air and surface met stations chosen.

- Review PCRAMMET log file and make sure you agree with the inputs used in the processing. Pay special attention to the surface roughness length used for the application site because the modeled results are very sensitive to this value. A detailed discussion on the calculation of the surface roughness length should be submitted and rigorously reviewed. A procedure for calculating the surface roughness length is outlined in Section 3.2.2.2 of the Protocol. An alternative procedure may be used, but should be agreed upon by the applicant and the permitting authority before the modeling study is performed.

- Review method used to fill any missing data in surface and upper air raw met files. The EPA method documented on the EPA SCRAM (Support Center for Regulatory Air Models) web site should be used for filling any missing data. The unedited raw met data files (surface and/or upper air) should be provided with the edited raw met data files used for the air modeling.

- It is common and acceptable to have warning messages associated with the PCRAMMET log file. The usual messages are: "rural mixing heights<10m" and "the program had to select a single precipitation type from multiple types". These are normal messages generated by PCRAMMET. Any other messages should be discussed with an experienced meteorologist or air modeler.

2. NAD 83 vs. NAD 27

- Most USGS paper 7.5-minute topographic maps are published in the North American Datum system established in 1927 (NAD 27). However, most digital elevation data (e.g., USGS Digital Elevation Mapping) is in the 1983 revised system (NAD 83). Special caution should be used not to mix source data obtained from USGS maps based on NAD 27 with digital terrain elevation data based on NAD 83. Documentation should be given showing that these data were not mixed.

3. Downwash (BPIP)

- Plot the source and building locations found in the BPIP input file and see if they match the plot plan and/or USGS map. (Note: if the applicant submitted the locations in the NAD83 coordinate system they will be shifted in location on a USGS published 7.5 minute topographic map)

- Check stack and building base elevations in the BPIP input file and see if they match the plot plan and/or USGS map.

- If the two above procedures check out, then you can assume the downwash analysis was performed correctly.

4. Particle Size Distribution Calculations

- Spot-check the particle size distribution calculations (i.e., mean particle diameters, mass-weighted mass fractions for particle phase, surface-weighted mass fractions for particle-bound phase, and scavenging coefficient determinations). Make sure they correlate appropriately with the raw stack test data. Note that if the mass is erroneously weighted more heavily toward the smaller particle sizes than the stack test indicates is appropriate, deposition rates could be significantly under-predicted. (See Table 3-1 of Protocol)

5. ISCST3 Input/Output Files

A. Control Pathway

- Make sure the regulatory default option was chosen.

- Make sure the "ANNUAL" average and "1" hour average options were specified (and any other averaging period your agency requires, if applicable). The "ANNUAL" average option is chosen to compute chronic health risk. The "1" hour average is to compute acute health risks based on the maximum 1-hour average concentrations over the 5-year period.

- Make sure the dispersion coefficients chosen (urban or rural) are representative of the land use and vegetation coverage within 3 kilometers of the site. A detailed procedure on how to make this determination is given in Section 3.2.2.1 of the Protocol.

- Make sure the correct concentration, deposition, and depletion options were chosen for the particular phase and type of grid nodes being evaluated (see Section 3.7.1 of the Protocol).

- Make sure the applicant is using the latest version of ISCST3 from the EPA SCRAM web site, or the Lakes Environmental 'ISC3View' program which integrates the latest ISCST3.

B. Source Pathway

- Plot the source location used in the modeling to make sure the locations look right relative to other sources, the property line, and off-site grid nodes.

- Make sure the stack heights used in the modeling are actual stack heights and not GEP stack heights calculated by the BPIP pre-processor. Make sure the base elevation of the stacks to be modeled are consistent with grid node elevations.

- Make sure the stack parameters are representative of the proposed operating conditions (i.e. average, normal or worst case) of the facility (check stack test temperature and actual flow rates) as approved by the permitting authority.

- Spot-check one input file for each phase (vapor, particle-bound, particle) for each source to make sure stack locations and parameters were input correctly, downwash parameters match the BPIP output, and particle size data were input correctly including scavenging coefficients.

- Make sure a unit emission rate of 1 gram/second was used.

C. Receptor Pathway

- Look at the plotted grid nodes (referred to in ISCST3 documentation as 'receptors') in the modeling report. If not available, post the grid nodes from one plot file using a graphics program (e.g., Surfer). Check to make sure the grid is adequate (i.e., conforms to the Protocol). The recommended grid node array is described in Section 3.7.3 of the Protocol.

- Spot-check several grid node elevations comparing them to the contours on a USGS map, if elevated terrain was employed. Make sure there are non-zero elevation values in the array.

D. Meteorological Pathway

- Check the anemometer height to make sure it is the correct one for that station and met year. Two sources of correct anemometer height include the state air modeler (meteorologist) and Local Climatological Data Summary (LCD) available from NCDC.

- Check to make sure the correct surface and upper air station 5-digit identifiers were specified. Also, make sure that the beginning met year was specified correctly.

- The option is given to combine the 5 single year met files into one composite 5-year met file. The result is that the modeling output will already be in the 5-year averaged format and will not require post-processing. However, there are critical issues to be aware of when creating this composite 5-year met file. These issues are discussed in Section 3.7.4 of the Protocol.

E. Output Pathway

- Make sure that ISCST3 plot files were created and submitted via magnetic media.

6. Test Runs

- Choose a critical model run or set of model runs (i.e., ones that resulted in the highest risk).

- Choose one or more critical grid nodes (referred to in ISC User's Guide as receptors) and delete all other grid nodes except for the desired one(s).

- Run model, then compare the results to the results presented in the modeling report for those same critical grid nodes.

7. 5-Year Average Values for Risk Assessment

- If single year met files were used, hand-calculate the 5-year average concentration, dry deposition, and wet deposition at a critical receptor grid node for verification.

- Check the area average total deposition rates used for the water bodies and watershed. Total deposition has proven to be a critical pathway for several COPCs.

- Plot the isopleths (contours) of the 5-year average concentration, wet deposition, and dry deposition for patterns around the stack using a graphics program (e.g., Surfer).

- Check particle, particle-bound, and vapor runs for consistency (non-zero values, large particles have higher deposition rates close to source location).