

(including partial years), up to five years, of site specific data is available, these data are preferred for use in air quality analyses. Such data should have been subjected to quality assurance procedures as described in subsection 9.3.3.2.

c. For permitted sources whose emission limitations are based on a specific year of meteorological data, that year should be added to any longer period being used (e.g., 5 years of NWS data) when modeling the facility at a later time.

d. For LRT situations (subsection 7.2.3) and for complex wind situations (paragraph 8.2.8(a)), if only NWS or comparable standard meteorological observations are employed, five years of meteorological data (within and near the modeling domain) should be used. Consecutive years from the most recent, readily available 5-year period are preferred. Less than five, but at least three, years of meteorological data (need not be consecutive) may be used if mesoscale meteorological fields are available, as discussed in paragraph 9.3(c). These mesoscale meteorological fields should be used in conjunction with available standard NWS or comparable meteorological observations within and near the modeling domain. If site specific meteorological data are available, these data may be especially helpful for local-scale complex wind situations, when appropriately blended together with standard NWS or comparable observations and mesoscale meteorological fields.

9.3.2 National Weather Service Data

9.3.2.1 Discussion

a. The NWS meteorological data are routinely available and familiar to most model users. Although the NWS does not provide direct measurements of all the needed dispersion model input variables, methods have been developed and successfully used to translate the basic NWS data to the needed model input. Site specific measurements of model input parameters have been made for many modeling studies, and those methods and techniques are becoming more widely applied, especially in situations such as complex terrain applications, where available NWS data are not adequately representative. However, there are many model applications where NWS data are adequately representative, and the applications still rely heavily on the NWS data.

b. Many models use the standard hourly weather observations available from the National Climatic Data Center (NCDC). These observations are then preprocessed before they can be used in the models.

9.3.2.2 Recommendations

a. The preferred models listed in Appendix A all accept as input the NWS meteorological data preprocessed into model compatible form. If NWS data are judged to be adequately representative for a particular modeling application, they may be used. NCDC makes available surface^{97,98} and upper air⁹⁹ meteorological data in CD-ROM format.

b. Although most NWS measurements are made at a standard height of 10 meters, the

actual anemometer height should be used as input to the preferred model.

c. Wind directions observed by the National Weather Service are reported to the nearest 10 degrees. A specific set of randomly generated numbers has been developed for use with the preferred EPA models and should be used with NWS data to ensure a lack of bias in wind direction assignments within the models.

d. Data from universities, FAA, military stations, industry and pollution control agencies may be used if such data are equivalent in accuracy and detail to the NWS data, and they are judged to be adequately representative for the particular application.

9.3.3 Site Specific Data

9.3.3.1 Discussion

a. Spatial or geographical representativeness is best achieved by collection of all of the needed model input data in close proximity to the actual site of the source(s). Site specific measured data are therefore preferred as model input, provided that appropriate instrumentation and quality assurance procedures are followed and that the data collected are adequately representative (free from inappropriate local or microscale influences) and compatible with the input requirements of the model to be used. It should be noted that, while site specific measurements are frequently made "on-property" (i.e., on the source's premises), acquisition of adequately representative site specific data does not preclude collection of data from a location off property. Conversely, collection of meteorological data on a source's property does not of itself guarantee adequate representativeness. For help in determining representativeness of site specific measurements, technical guidance¹⁰⁰ is available. Site specific data should always be reviewed for representativeness and consistency by a qualified meteorologist.

9.3.3.2 Recommendations

a. EPA guidance¹⁰⁰ provides recommendations on the collection and use of site specific meteorological data. Recommendations on characteristics, siting, and exposure of meteorological instruments and on data recording, processing, completeness requirements, reporting, and archiving are also included. This publication should be used as a supplement to other limited guidance on these subjects.^{91,101,102} Detailed information on quality assurance is also available.¹⁰³ As a minimum, site specific measurements of ambient air temperature, transport wind speed and direction, and the variables necessary to estimate atmospheric dispersion should be available in meteorological data sets to be used in modeling. Care should be taken to ensure that meteorological instruments are located to provide representative characterization of pollutant transport between sources and receptors of interest. The appropriate reviewing authority (paragraph 3.0(b)) is available to help determine the appropriateness of the measurement locations.

b. All site specific data should be reduced to hourly averages. Table 9-3 lists the wind

related parameters and the averaging time requirements.

c. *Missing Data Substitution.* After valid data retrieval requirements have been met¹⁰⁰, hours in the record having missing data should be treated according to an established data substitution protocol provided that data from an adequately representative alternative site are available. Such protocols are usually part of the approved monitoring program plan. Data substitution guidance is provided in Section 5.3 of reference 100. If no representative alternative data are available for substitution, the absent data should be coded as missing using missing data codes appropriate to the applicable meteorological pre-processor. Appropriate model options for treating missing data, if available in the model, should be employed.

d. *Solar Radiation Measurements.* Total solar radiation or net radiation should be measured with a reliable pyranometer or net radiometer, sited and operated in accordance with established site specific meteorological guidance.^{100,103}

e. *Temperature Measurements.*

Temperature measurements should be made at standard shelter height (2m) in accordance with established site specific meteorological guidance.¹⁰⁰

f. *Temperature Difference Measurements.* Temperature difference (δT) measurements should be obtained using matched thermometers or a reliable thermocouple system to achieve adequate accuracy. Siting, probe placement, and operation of δT systems should be based on guidance found in Chapter 3 of reference 100, and such guidance should be followed when obtaining vertical temperature gradient data.

g. *Winds Aloft.* For simulation of plume rise and dispersion of a plume emitted from a stack, characterization of the wind profile up through the layer in which the plume disperses is required. This is especially important in complex terrain and/or complex wind situations where wind measurements at heights up to hundreds of meters above stack base may be required in some circumstances. For tall stacks when site specific data are needed, these winds have been obtained traditionally using meteorological sensors mounted on tall towers. A feasible alternative to tall towers is the use of meteorological remote sensing instruments (e.g., acoustic sounders or radar wind profilers) to provide winds aloft, coupled with 10-meter towers to provide the near-surface winds. (For specific requirements for CTDMPLUS, see Appendix A.) Specifications for wind measuring instruments and systems are contained in reference 100.

h. *Turbulence.* There are several dispersion models that are capable of using direct measurements of turbulence (wind fluctuations) in the characterization of the vertical and lateral dispersion (e.g., CTDMPLUS and CALPUFF). For specific requirements for CTDMPLUS and CALPUFF, see Appendix A. For technical guidance on measurement and processing of turbulence parameters, see reference 100. When turbulence data are used in this manner to directly characterize the vertical and lateral dispersion, the averaging time for the turbulence measurements should be one hour