CCNPP3COLA NPEmails

From: John Rycyna
Sent: Wednesday, January 21, 2009 8:50 AM
To: Poche, Robert
Cc: CCNPP3COL Resource; Michael Mazaika; Brad Harvey; Charles Cox
Subject: Information Needs for Meteorology Audit
Attachments: Information Needs for Meteorology Audit Rev1 (011609).doc

Bob,

Attached are the information needs for the audit on January 28 and January 29.

Mike Mazaika, Brad Harvey and I will attend.

Please provide the address of the office where it will be.

Thank you.

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From: John Rycyna

Created By: John.Rycyna@nrc.gov

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Information Needs for Meteorology Audit of AEOLUS3 Dispersion Model

Documentation

Please make available the following items for reference and demonstration during the audit:

- Hard copies of AEOLUS3 user's manual, verification and validation report (if available), and other related documentation (none of these items will be retained by NRC staff)

- If possible, at least one laptop PC for demonstrating model set-up, input data entry process, and model output (recommend that examples be specific to CCNPP3)

Technical Issues Related to Input Data and Assumptions Pertaining to Short-Term and/or Long-Term X/Q Estimates by the AEOLUS3 Model

Please provide a subject matter expert(s) to discuss the following:

- General overview and demonstration of AEOLUS3 dispersion model

- Any modifications to the short-term, accident-related dispersion equations and methodologies in:

  - RG 1.145 (Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants); and

  - NUREG/CR-2858 (PNL-4413) (PAVAN: An Atmospheric Dispersion Program for Evaluating Design Basis Accidental Releases of Radioactive Materials from Nuclear Power Stations)

- Any modifications to the long-term, routine release-related dispersion equations and methodologies in:

  - RG 1.111 (Methods for Estimating Atmospheric Transport and Dispersion of Gaseous Effluents in Routine Releases from Light-Water-Cooled Reactors); and

  - NUREG/CR-2919 (PNL-4380) (XOQDOQ: Computer Program for the Meteorological Evaluation of Routine Effluent Releases at Nuclear Power Stations)

- AEOLUS3 batch-input mode operation and user-selectable options, including:

  - explanation of batch-mode structure;
  - whether "batch-mode" corresponds to separate model runs (e.g., for individual annual cycles of meteorological data);
  - if other input data are entered as groups of related information;
  - identification of user-selectable options;
  - identification of default values among options (if any), and, if so, rationale for selecting default/non-default values; and
  - options selected for CCNPP3 dispersion modeling.

- If the model is run separately depending on whether short-term, accident-related or long-term routine release-related X/Qs are being estimated.

  - If not run separately, explain how the model isolates the appropriate annual average X/Qs (e.g., at EAB and LPZ boundary receptors) depending on whether the X/Qs are associated with short-term accident or long-term routine release conditions since the annual average

X/Qs could be fundamentally different if short-term dispersion is evaluated as a ground level release and long-term dispersion is evaluated as mixed mode releases.

- Whether and, if so, how the short-term accident model generates:

  - the safety-related 0.5 percent, sector-dependent X/Qs pursuant to Regulatory Position 2 in RG 1.145;
  - the safety-related 5 percent overall site X/Qs pursuant to Regulatory Position 3 in RG 1.145; and
  - the environmental impact-related 50 percent, sector-dependent and the 5 percent overall site limit X/Qs;

  including an explanation of how the respective upper bound curves of the X/Qs versus probability of being exceeded are constructed and used.

- Whether the controlling safety-related X/Q value (i.e., the higher of the maximum sector-dependent or the 5 percent overall site limit value, pursuant to Regulatory Position 4 in RG 1.145) is identified internally as part of the model output or must be identified and selected manually from the output. If the latter, provide examples specific to the CCNPP3 COLA.

- Whether and, if so, how the AEOLUS3 model accounts for fumigation conditions, including:

  - its applicability to modeling of short-term, accident-related and long-term, routine ground-level releases;

  - its applicability to stack releases and the elevated portion of long-term routine releases under mixed-mode scenarios;

  - its interaction with the presence of a thermal internal boundary layer (TIBL) in coastal locations.

- How the AEOLUS3 model differs in its handling of fumigation at coastal locations (would apply to the Calvert Cliffs and Nine Mile Point COL applications) and at inland locations (would apply to the Bell Bend and Callaway COL Applications) in relatively open terrain and in complex terrain (e.g., mountain ridge and valley).

- How plume recirculation and stagnation effects are accounted for in the short-term, accident-related dispersion model and the long-term, routine release-related dispersion model in terms of required input data and implementation as a function of downwind distance and direction sector.

- How plume meander effects are accounted for in the short-term, accident-related dispersion model and the long-term, routine release-related dispersion model.

- How the long-term, routine release-related dispersion model accounts for plume depletion by wet deposition, dry deposition, and radioactive decay; and a discussion of gamma X/Qs.

- For mixed-mode scenarios, how the long-term, routine-related dispersion model:

  - determines and apportions the amount of time applicable to each release mode (elevated and ground-level) of a mixed-mode release and how that implementation relates to Regulatory Position 2(b) of RG 1.111; and

  - how this determination varies depending on whether JFDs or hourly data are input to the model, and whether wind speed data from the 10-m level only or both the 10- and 60-m measurement levels are used.

- How receptors are generated by and/or input to the AEOLUS3 model, including:
  - at the EAB and LPZ boundary distances;
  - for fixed radial distances (and the basis for those distances);
  - for distance segments (and the basis for those distance ranges); and
  - at special receptor locations (e.g., nearest residence, garden, meat animal, milk animal).

- How the AEOLUS3 model handles terrain heights as a function of release height and downwind distance from the source to different terrain elevations within the same sector in comparison to how this is handled by the PAVAN and XOQDOQ dispersion models.

- Whether and, if so, how terrain heights can be assigned to special receptors.

Technical Issues Related to Meteorological Data as Input to the AEOLUS3 Model for Short-Term and/or Long-Term X/Q Estimates

Please provide a subject matter expert(s) to discuss the following:

- Whether joint frequency distributions (JFDs) for each stability class are directly input to the AEOLUS3 model for estimating short-term accident and long-term routine release X/Qs, or if the code operates on one or more sequential hourly data sets.

- If the model actually runs on JFDs, how the frequencies of occurrence of wind speed and wind direction by atmospheric stability class, and how the frequencies of calm wind conditions by stability class, are input to the code.

- If the model actually runs on sequential hourly data, specify or explain:
  - what the limit is on the period of record (POR), presumably in years, that can be input to the code;
  - if the POR used for an analysis exceeds the maximum length that can be input to the model, how the modeling results are integrated (or post-processed) to develop both short-term X/Q statistics (e.g., probability distributions and upper bound curves) and long-term statistics that represent the composite data set;
  - if the start/end dates for a POR are constrained to a calendar year (i.e., January 1 thru December 31) or if the start/end dates for a POR can cover a different annual cycle (e.g., July 1 thru June 30);
  - how wind speeds and wind directions are sorted internally by the model (e.g., into wind speed class and direction sector groupings in equivalent to a JFD);
  - whether the actual hourly wind speed value is used in the X/Q calculation or if the average or maximum wind speed for the equivalent JFD wind speed class is used (and the circumstances in which the average or the maximum wind speed value is selected);
  - whether and, if so, how the model utilizes hourly sigma-theta wind data if delta-temperature (stability class) data are missing and, if applicable, the basis for the sigma-theta stability typing scheme; and
  - whether and, if so, how missing hourly data are handled and how X/Q results are to be interpreted if individual parameter or joint data recovery is less than the 90 percent criterion specified in RG 1.23.

- Whether JFDs or sequential hourly data for only one wind measurement level can be input to the same AEOLUS3 model run.
    - If only one measurement level can be input, specify the nominal wind measurement height;
    - If more than one measurement level can be input, explain how the model selectively uses the wind speed and wind direction data for ground-level releases and the elevated portion of mixed-mode releases.
- Wind speed scaling factors internal to the AEOLUS3 model that are used to extrapolate wind speeds measured at one level to an elevated release height when applicable to the elevated portion of mixed-mode releases.
- Regarding mixing height:
    - whether the AEOLUS3 model is limited to the input of a single annual average value only or if multiple mixing heights (e.g., seasonal average values) can be entered;
    - if the value(s) should represent a morning, afternoon, or daily average mixing height and the technical basis for that approach; and
    - how representative a daily or afternoon average value is of the boundary layer conditions that result in the relatively higher X/Qs that occur primarily at nighttime
- Whether and, if so, how the mixing height affects the diffusion of ground-level releases and the elevated portion of mixed mode releases:
    - in terms of any differences between short-term, accident-related and long-term, routine release-related analyses;
    - as a function of downwind distance;
    - as a function of time of day;
    - as a function of stability class (especially for stable conditions); and
    - in terms of plume reflection.