BREAKOUT SESSIONS

SESSION IV

BREAKOUT ONE

METHODS FOR VALIDATION, VERIFICATION AND APPROVAL (VV&A) OF MODELS

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Rapporteur: Ms. Marcia Carpentier, Environmental Protection Agency

Synopsis

The goal of Breakout One was to describe existing methods of validation, verification and approval used within the agencies and to begin developing a common framework for the verification and inter-comparison of models. Although model evaluation is going on within the agencies, current methods vary from the formal regulatory process used by the EPA to a less formal, self-imposed process by the DOE. The DOD is developing a process which will be part of the formal system acquisition procedures. The NOAA uses a continuous process which compares new models against existing models. Although there was general agreement that model evaluation is needed, a number of issues were raised that complicate the process. These included the need to evaluate models for the application of intended use, the cost and time for field studies, the availability and sharing of data sets, the fact that models predict mean values and not point values, and the difficulty of decoupling model evaluation from model acceptance by the user. It was also mentioned that the process being developed by the DOD and the guidelines developed by the American Society for Testing and Materials (ASTM) might serve as models for a more rigorous process for model evaluation. A summary from Breakout One follows on pages 3-2 and 3-3.

Summary of VV&A Breakout Session

Model Evaluation = Verification and Validation

•Elements:

- -Operational testing or sensitivity analysis.
- -Independent methodology evaluation or peer review.
- -Comparison against measured data.

Approval involves sponsor/user concluding that model should be used for a specified range of applications.

•Current Procedures

- -DOE: self-imposed; no formal process.
- -DOD: being developed; formal acquisition procedure for EMIS/D2PC and MIDAS-AT.
- -EPA: formal regulatory approval process including public review and comment.
- -NOAA: comparison of new against existing as continuous process.
- -FEMA: same as NOAA.

•More on EPA process

- -Defined regulatory "niches".
- -One guideline model for each niche but many models submitted.
- -1980 solicitation for new models to allow technological advances.
- -Modeling clearinghouse established to evaluate model applications.
- -Potential problem with inertia (slow process).

•ASTM Standard Guide for Evaluation of Dispersion Models

- -ASTM develops widely varying standards.
- -Several federal organizations represented in D-22 subgroup (meteorologists).
- -Covers basic procedures but not specifics such as statistics (general philosophy).

•Issues

- -Difficulty in decoupling evaluation from acceptance (model must meet user's needs).
- -Evaluation process quite expensive.
- -Woods Hole: too many statistics.
- -Who is the audience for the evaluation?
- -Lack of database or data exchange - need lots of data to determine model accuracy.
- -Models predict means, we measure observations.

•Summary and Recommendations

-Model evaluation seems impossible but still gets done (Hanna dense gas models).

-Recommend staying involved with ASTM subgroup - may adopt guidelines.

-Facilitate data sharing between organizations.

BREAKOUT TWO

ESTABLISHING SUBSETS OF MODELS TO MEET DISPERSION APPLICATIONS

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Rapporteur: Mr. Ron Meris, Defense Threat Reduction Agency

Synopsis

The objective of Breakout Two was to propose a process for establishing model subsets for specific applications. After considerable discussion, it was decided to identify types of models for different applications rather than specific models by name. A set of model characteristics shown on page 3-5 was used to begin the process. During this session, the focus was on identifying types of models with time scales of minutes to weeks and spatial scales from building size to thousands of kilometers. An initial assessment of production time and identification of applicable agencies was also made. This process has much further to go, and the need for a follow-on meeting was identified as a recommended action. A summary from Breakout Two follows on pages 3-5 through 3-7.

Summary of Subsets Breakout Session

•Many model characteristics need to be considered.
- -Time and space scales
- -Frame of Reference (Eulerian or Lagrangian)
- -Steady state or time dependent
- -Pollutant properties (gas/particle) and chemical reactions
- -Plume behavior (buoyant/dense; downwash)
- -Turbulence parameterization
- -Topography and removal processes
- -Treatment of uncertainty
- -Numerical solution method

•Established a framework to identify types of models appropriate to various applications.
•Concentrated on time and space scales to get started.
•Much more detail needed to fill in the framework.

<u>Subsets Based on Space and Time Scales</u>

•Space scale: inside a building
•Time scale: few minutes to 1 hour
•Model types:
- -CFD - good for low speed, auditorium type
- -Multizonal good for energetic flow with multiple rooms

•Production time (within 1 hour of "cold start") - multizonal only
•Agencies with capability: DOE, EPA, DOD, NIST

•Space scale: single building - 10m x 100m
•Time scale: few minutes
•Model types:
- -CFD
- -Parameterized Gaussian
- -Physical modeling

•Production time: planning tool only, no model for immediate response
•Agencies with capability: DOE, DOD, EPA, NOAA

•Space scale: neighborhood, 2 x 5 km horizontal, sfc - 100m vertical
•Time scale: 30 minutes to days
•Model types:
    -Particle (near field)
    -CFD (mixed, large eddy simulation [LES])
    -Modified Gaussian
    -Puff trajectory with mass consistent winds
•Production time: 20 min for modified Gaussian and Puff
•Agencies with capability: DOE, DOD, EPA, NOAA

•Space scale: micro scale, 20 x 20 km horizontal, sfc to BL vertical
•Time scale: convective 10-15 mins, advective 1 hr
•Model types:
    -Trajectory
    -Gaussian Plume or Puff
    -CFD particle
•Production time: within 20 min for all Gaussian, CFD particle and trajectory types; requires more fine scale meteorology to meet regulatory considerations
•Agencies with capability: ALL

•Space scale: mesoscale, 50 x 1000 km horizontal, sfc to BL vertical
•Time scale: Hours to 24 hours
•Model types:
    -Gaussian Puff or Particle
    -Eulerian
    -Hybrid Eulerian and Lagrangian
•Production time: within 20 min for all model types.
•Agencies with capability: DOD, DOE, NOAA, EPA, NASA

•Space scale: continental, 3000 x 4000 km
•Time scale: several days
•Model types:
    -Lagrangian puff
    -Transport key; not diffusion
•Production time: within 20 min for all model types.
•Agencies with capability: NOAA, DOE, DOD, NSF, EPA, NASA

•Space scale: global
•Time scale: weeks
•Model types:
    -Numerical Weather Prediction (NWP) is key
    -Lagrangian particle trajectory
•Production time: within 20 min
•Agencies with capability: DOD, DOE, NSF, NASA, NOAA

•Recommended Actions:
    -Conduct follow-on meetings.
    -Conduct scientific reviews/discussion.