PRESENTATIONS

SESSION II

AGENCY DISPERSION MODELING CAPABILITIES

Chair: Mr. Jeffrey McQueen, NOAA Air Resources Laboratory
Rapporteur: Mr. David Weinbrenner, National Centers for Environmental Prediction

Synopsis

During Session II, agencies presented their dispersion modeling capabilities to meet current requirements. Model evaluation, model output, types of users, and research and development to meet unmet needs were also presented by some of the agencies. The EPA presented a broad range of models categorized as screening models, regulatory models, other models (non-regulatory), models under public review, and non-EPA models. The screening models are geared to provide a simple tool to determine compliance with regulations. Examples of models in this category are SCREEN3, TSCREEN, CTSCREEN, and RTDM. Regulatory models are more sophisticated tools for determining compliance and include such models as ISCST3, UAM, CTDMPLUS, and OCD. Models classified as other models and models under public review are those which have not undergone the procedures required to be classified as regulatory. The EPA's Support Center for Regulatory Air Models (SCRAM) maintains a website (www.epa.gov/ttn/scram/) which includes information on model availability, training, and answers general questions about the state of regulatory modeling.

Presentations from the DOD included the Army Research Laboratory, Defense Threat Reduction Agency, Air Force Research Laboratory, and the U. S. Navy's Naval Surface Warfare Center. The Army Research Laboratory highlighted capabilities in both transport and diffusion models. These included transport models with varying scales from mesoscale to microscale; domains from a few square km's to several hundred square km's; grids from 50m to 10km; and with surface layer hi-resolution terrain and morphology effects. Capabilities in diffusion modeling included gaussian plume over flat terrain, gaussian puff over complex terrain, gaussian puff over canopies/buildings, and secondary surface evaporation. Currently, meteorological transport models such as HRW and CCSL and a diffusion code, RIMPUFF, are being combined as an integrated transport and diffusion simulation capability. The Army's operational models include D2-PC, SCIPUFF for diffusion and MM-5 for transport. The Defense Threat Reduction Agency's primary capability is the Hazard Prediction & Assessment Capability (HPAC). This is a transport and diffusion system that is forward deployable and is used for counterproliferation, counterforce and counter-terrorism purposes against weapons of mass destruction (WMD) for both DOD and civil support. HPAC has multiple users from the DOD and also from civilian agencies including the DOE, Department of State, Department of Justice and FEMA. Continued

research and development activities are focused on meeting requirements particularly in the area of urban modeling.

The Air Force Research Laboratory described its capabilities in the area of atmospheric chemistry and emphasized that this is a key piece to completing the total picture of dispersion modeling. Atmospheric chemistry has relevance to dispersion modeling with respect to the transformations of volatile organic compounds and the effects of chemical composition and concentration within the dispersion plume. The U. S. Navy's Naval Surface Warfare Center presented their capabilities in modeling and simulation for chemical/biological (CB) defense. The presentation focused on VLSTRACK which is the DOD standard model for CB attacks; MESO-NEXT GENERATION which deals with more complex flow and planetary boundary layers; and CFX which is a computational fluid dynamics code for CB warfare and provides hazard assessment for ships, port facilities, urban regions, and air bases.

For the DOE, dispersion modeling activities are performed within the Environmental Meteorology Program (EMP) and the Atmospheric Chemistry Program (ACP) and within the Office of Emergency Operations' Chemical and Biological Nonproliferation Program. (CBNP). The EMP focuses on the transport of energy-related materials through the atmosphere and the ACP focuses on the chemical transformation of tropospheric energy-related materials on regional, continental, and global scales. The web address for EMP is <gonzalo.er.anl.gov/ACP/> and the web address for EMP is <www.pnl.gov/VTMX/>. Most of the work in these programs is research oriented using models to understand the physics. In the EMP, research work is being done using Large Eddy Simulation (LES) and Direct Numerical Simulation (DNS) to resolve small scale turbulence. The DOE Atmospheric Sciences Program has also conducted several field experiments as part of their research and development work in dispersion and atmospheric chemistry. An active research and development program is ongoing to evaluate and improve topography in meso models, to evaluate sub-grid scale turbulence parameterizations, and to compare simulated turbulence with observed turbulence. The DOE CBNP effort is focused on the development of a suite of multi-scale transport and fate models for chemical and biological agent releases within the urban environment. Both interior (buildings and subways) and exterior dispersion models are being developed. The exterior models include computational fluid dynamics (CFD) models with the ability to resolve individual buildings as well as regional models that rely on urban parameterizations. The CBNP has also initiated a large-scale urban dispersion experimental program to provide field data for model evaluation. The DOE Office of Emergency Operations has developed a response capability that is based on a graded approach where the model complexity used for a particular emergency response application is commensurate with the complexity or scale of the incident. These capabilities include the HOTSPOT health physics codes which can be deployed to emergency response personnel; an atmospheric dispersion and consequence prediction capability which is based on the AIRRAD radionuclide fallout and ERAD high explosive dispersal models and is deployed with an expert; and the National Atmospheric Release Assessment Center (NARAC) which utilizes the ADAPT diagnostic windfield code, the COAMPS mesoscale meteorology model, the KDFOC fallout code and the LODI regional dispersion model, and also provides reach-back capability to the national center's expert staff.

NOAA uses a number of operational models to meet current requirements. These requirements include guarding people/property, improving quality/timeliness of dispersion forecasts, reducing costs of property damage, and reducing the vulnerabilities of the public to hazardous concentrations of materials dispersed from various sources. The NOAA Air Resources Laboratory issues daily predictions for elements such as ozone concentrations. The Air Resources Laboratory as well as the National Weather Service and the National Ocean Service also cover emergencies such as radiological releases, volcanic ash, smoke from forest fires, and hazardous material spills. NOAA conducts various model evaluations, has a wide range of users, and conducts extensive research and development in areas such as coupling dispersion models with meteorological and chemical models, air-surface exchange and deposition, and assimilation of plume predictions with surface observations and satellite imagery.

As stated in Session I, the NRC's requirements for dispersion modeling are driven by site suitability studies, incident response and cost/benefit analyses. For waste repository site suitability studies, where the accident of interest is volcanic eruption for the post-closure period, the NRC's capability rests with the Suzuki model. For plant design and plant site suitability evaluations, chi/Q met analyses are used. For incident response, severe accidents, and cost/benefit analyses, the Gaussian plume is used.

At both the USAF Eastern and Western Ranges there is a considerable capability for forecasting toxic hazards in support of space and missile operations. These capabilities include the Hybrid Particle and Concentration Transport (HYPACT) Model, the Ocean Breeze/Dry Gulch (OB/DG) Model, the Air Force Toxic Chemical Dispersion Model (AFTOX), and the Rocket Exhaust Effluent Diffusion Model (REEDM).

The Department of Transportation described its capability with the Automated Resource for Chemical Hazard Incident Evaluation (ARCHIE). The objective of ARCHIE is to provide a set of hazard and consequence analysis tools applicable to hazardous materials. This capability is applicable to planners and emergency responders in developing response plans and in managing risk associated with the release of a hazardous material.

For information on Session II presentations, see Appendix C.