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Overview of the National Atmospheric Release Advisory Center's urban research and development activities

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Overview of the National Atmospheric Release Advisory Center's urban research and development activities

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A39 : Urban Dispersion Modeling for Chemical, Biological, and Radiological Releases: Current Status and Research Needs

This presentation describes the tools and services provided by the National Atmospheric Release Advisory Center (NARAC) at Lawrence Livermore National Laboratory (LLNL) for modeling the impacts of airborne hazardous materials. NARAC provides atmospheric plume modeling tools and services for chemical, biological, radiological, and nuclear airborne hazards. NARAC can simulate downwind effects from a variety of scenarios, including fires, industrial and transportation accidents, radiation dispersal device explosions, hazardous material spills, sprayers, nuclear power plant accidents, and nuclear detonations. NARAC collaborates on radiological dispersion source terms and effects models with Sandia National Laboratories and the U.S. Nuclear Regulatory Commission. NARAC was designated the interim provider of capabilities for the Department of Homeland Security's Interagency Modeling and Atmospheric Assessment Center by the Homeland Security Council in April 2004.

The NARAC suite of software tools include simple stand-alone, local-scale plume modeling tools for end-user's computers, and Web- and Internet-based software to access advanced modeling tools and expert analyses from the national center at LLNL. Initial automated, 3-D predictions of plume exposure limits and protective action guidelines for emergency responders and managers are available from the center in 5-10 minutes. These can be followed immediately by quality-assured, refined analyses by 24 x 7 on-duty or on-call NARAC staff. NARAC continues to refine calculations using updated on-scene information, including measurements, until all airborne releases have stopped and the hazardous threats are mapped and impacts assessed.

Model predictions include the 3-D spatial and time-varying effects of weather, land use, and terrain, on scales from the local to regional to global. Real-time meteorological data and forecasts are provided by redundant communications links

to the U.S. National Oceanic and Atmospheric Administration (NOAA), U.S. Navy, and U.S. Air Force, as well as an in-house mesoscale numerical weather prediction model. NARAC provides an easy-to-use Geographical Information System (GIS) for display of plume predictions with affected population counts and detailed maps, and the ability to export plume predictions to other standard GIS capabilities. Data collection and product distribution is provided through a variety of communication methods, including dial-up, satellite, and wired and wireless networks.

Ongoing research and development activities will be highlighted. The NARAC scientific support team is developing urban parameterizations for use in a regional dispersion model (see companion paper by Delle Monache). Modifications to the numerical weather prediction model WRF to account for characteristics of urban dynamics are also in progress, as is boundary-layer turbulence model development for simulations with resolutions greater than 1km. The NARAC building-resolving computational fluid dynamics capability, FEM3MP, enjoys ongoing development activities such as the expansion of its ability to model releases of dense gases. Other research activities include sensor-data fusion, such as the reconstruction of unknown source terms from sparse and disparate observations.

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