



National Atmospheric Release Advisory Center

NARAC

Using unique expertise and tools, NARAC maps the spread and impacts of hazardous materials accidentally or intentionally released into the atmosphere. Timely, accurate plume predictions help emergency managers and responders protect the public and the environment.

Harnessing Science and Technology to Meet National Security Challenges

As one of Lawrence Livermore National Laboratory's signature facilities, NARAC is an example of the lab's ability to harness the power of science and technology and multi-disciplinary teams to deal with critical and complex national security challenges. The center was founded in 1979 during the Three Mile Island nuclear power plant accident. Since that time, NARAC has been serving the nation by preparing for, and responding to, other nuclear power plant and processing facility accidents (including Chernobyl and Fukushima Dai-ichi), industrial chemical spills and fires, radiological exercises and incidents, planetary mission launches involving radioactive materials, and natural disasters such as volcanic eruptions. The center's scope and capabilities are continually enhanced by cutting-edge research and improvements in computer software and hardware.

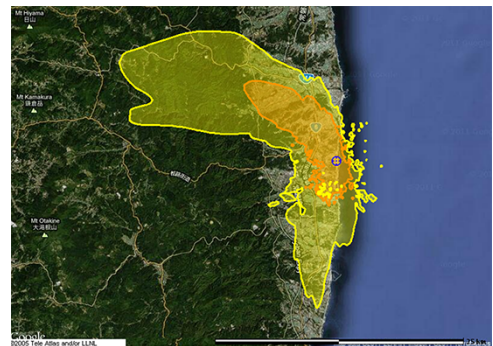
Preparing for and Responding to Emergencies

NARAC serves thousands of users from several hundred federal, state, and local agencies, emergency response teams, operations centers, and international organizations. In a typical year, the center fulfills 10,000 airborne-plume simulation requests for emergency preparedness, participates in 100 major emergency response exercises, and responds to 25 incidents. NARAC also maintains multiple websites for requesting and distributing plume predictions and sharing information during events.

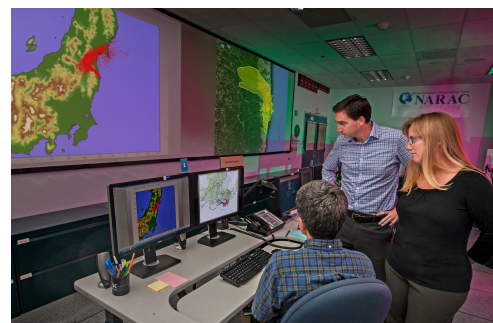
NARAC is the Department of Energy/National Nuclear Security Administration (DOE/NNSA) plume modeling center for radiological/nuclear incidents, providing predictions and analyses for DOE/NNSA's national operations center; regional, national, and international emergency response teams; and DOE sites across the country. The Naval Nuclear Propulsion Program (NNPP), various DoD facilities, and the National Aeronautics and Space Administration (NASA) also use NARAC for emergency preparedness and response. In addition, DOE/NARAC serves as the primary provider of radiological/nuclear plume modeling for the Department of Homeland Security-led Interagency Modeling and Atmospheric Assessment Center, whose role is to coordinate federal dispersion modeling and hazard prediction products during actual or potential incidents requiring federal coordination.



NARAC facility in Livermore, California.



Total Effective Dose for a hypothetical Fukushima Dai-ichi nuclear power plant release showing potential areas where emergency actions might need to be taken.



NARAC staff develop predictions and analyses of dispersion from hazardous atmospheric releases.

24/7 Model Predictions and Analyses

NARAC's 24/7 operations center can respond to multiple simultaneous events occurring anywhere in the world. NARAC's maps and graphical plots contain information on:

- Airborne and ground contamination areas
- Affected populations, including potential casualties and fatalities
- Areas exceeding dose, health effect, and protective action guide levels for sheltering, evacuation, relocation, worker protection, and agricultural product controls
- Damage estimates from explosions
- Geographical features, maps, aerial photos, and building footprints
- Updates to model predictions and analyses that incorporate field measurement data and other information as they become available

Services and Tools to Help Emergency Responders

NARAC's expert staff works closely with first responders, emergency operations centers, monitoring and sampling teams, and technical experts from a variety of federal, state, and local agencies. NARAC personnel have expertise in atmospheric dispersion, meteorology, hazardous material (radiological, chemical, biological) properties, physics, chemistry, health physics, numerical modeling, geographical information systems, computer science, software engineering, and computer graphics.

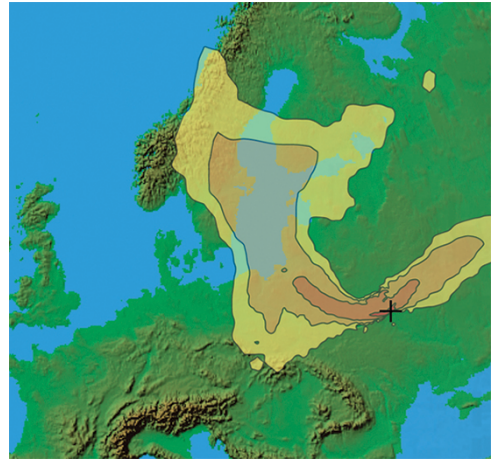
The center provides authorized users with high-fidelity modeling, analysis and geographical information tools, including the following:

- State-of-the-science 3-D atmospheric flow and dispersion modeling system
- Data acquisition systems and databases of global meteorological observations, weather-forecast model results, terrain elevation, land cover, population density, and maps
- Web browser access for authorized users to request, receive, and share NARAC predictions
- Sophisticated computational hardware and software that allow users to perform fully automated simulations in minutes on LLNL computers
- Stand-alone software for rapid plume predictions on users' computers
- 24/7 access to NARAC experts who provide quality-assurance, detailed plume model analyses, product interpretation and training

Research and Development to Advance Capabilities

NARAC conducts cutting-edge research in many topics related to airborne transport and fate, such as:

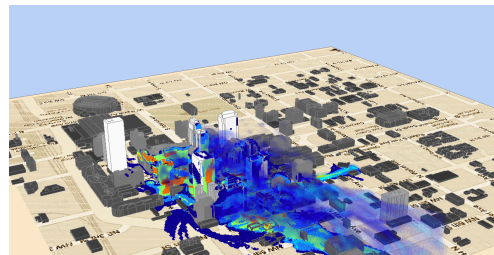
- Atmospheric turbulence and diffusion
- Boundary layer meteorology
- Urban flow and dispersion modeling
- Dense-gas transport in complex environments
- Indoor exposures
- Nuclear fallout
- Data-driven simulations for source estimation and event reconstruction
- Regional and urban meteorology and dispersion field experiments



NARAC prediction of ground-level air concentration pattern over Europe four days after the beginning of the Chernobyl nuclear power plant accident.



Smoke plume photograph with NARAC-simulated smoke particles in red for a tire dump fire. (Photo courtesy of Tracy Press)



NARAC conducts research and development to produce new capabilities such as high-fidelity computational fluid dynamics models for urban environments.