National Atmospheric Release Advisory Center

NARAC

NARAC offers unique expertise, tools, and services to map the spread and impacts of hazardous materials accidentally or intentionally released into the atmosphere. The center's primary mission is to help protect the public and the environment by providing timely, accurate plume and fallout predictions that aid emergency-response efforts. During a response, center experts work closely with monitoring and sampling teams to refine model predictions using field measurement data and other information.

NARAC is one of Lawrence Livermore National Laboratory's signature facilities and an example of the Laboratory'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 as part of the response to the Three Mile Island nuclear power plant accident. Since that time, NARAC has been serving the nation by responding to nuclear power plant and processing facility accidents (such as Chernobyl), industrial chemical spills and fires, radiological exercises and incidents, NASA planetary mission launches involving radioactive materials, and natural disasters such as volcanic eruptions. The center's scope and capabilities have steadily increased over the years via cutting-edge research and continual improvements in software and computers.

Users and Sponsors

NARAC serves thousands of users from over 300 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, participates in 100 major-emergency response exercises, and responds to 25 incidents.

NARAC is the Department of Energy/National Nuclear Security Administration (DOE/NNSA) Office of Emergency Response modeling center for radiological/nuclear events, supporting DOE/NNSA's regional and national emergency response teams, Operations Center, and sites across the country. The DOE/Department of Defense (DoD) Naval Nuclear Propulsion Program (NNPP) utilizes NARAC for emergency planning and response. The center also provides an International eXchange Program (IXP) Web site for support of international organizations through the DOE/NNSA Office of International Emergency Management and Cooperation.

The Federal government has designated NARAC as the operations hub for the Department of Homeland Security-led (DHS) Interagency Modeling and Atmospheric Assessment Center (IMAAC). IMAAC is "the single point for coordination and dissemination of Federal dispersion modeling and hazard prediction products that represent the Federal position" during actual or potential incidents involving hazardous chemical, biological, or radiological material releases. IMAAC supports the DHS National Operations Center, FEMA's National and Regional Response Coordinating Centers, and IMAAC stakeholders from the DHS, DoD, DOE, Environmental Protection Agency (EPA), Department of Health and Human Services (HHS), NASA, National Oceanic and Atmospheric Administration (NOAA), and the Nuclear Regulatory Commission (NRC). IMAAC capabilities are provided to state and local agencies upon request for major real-world emergencies.

NARAC facility in Livermore, California.

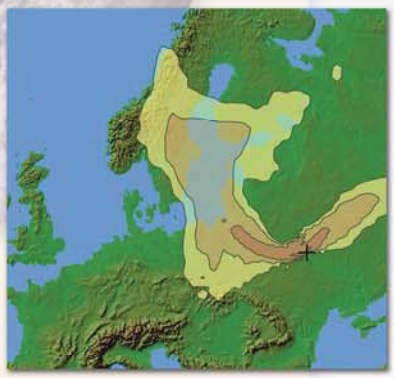
Plume predictions are accessed through NARAC Web software.

NARAC users access predictions in the field or in emergency operations centers using Web-based software.

Analyses and Plots

NARAC is a 24/7 operations center that can respond to multiple simultaneous events. The center provides timely information and analyses of the potential impacts of hazardous atmospheric releases, including graphical plots and detailed consequence reports of the following:

- Airborne and ground contamination areas
- Affected populations, including potential casualties and fatalities
- Areas potentially exceeding health effect and protective-action-guide levels for sheltering, evacuation, or relocation
- Damage estimates
- Geographical information, such as maps and aerial photos
- Refined predictions and analyses based on field data



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

Services and Tools

NARAC is staffed by nationally recognized experts who work closely with emergency responders, emergency operations centers, technical experts, field teams conducting monitoring and sampling, and experts from a variety of federal, state, and local agencies. The center also provides high-fidelity modeling and geographical information tools to authorized users. NARAC tools and services include the following:

- Advanced suite of modeling and analysis tools and supporting databases: NARAC computer systems collect and store global meteorological data and weather-forecast model results, as well as terrain, geographic and population data, and maps. These data are used in a sophisticated 3-D atmospheric flow and dispersion modeling system that can be utilized for any location in the world.
- *NARAC/IMAAC/CM/IXP Web*: NARAC provides Web browser access for trained and authorized users to request, receive, and share NARAC predictions.
- Computational hardware and software: NARAC's computers and software system allows users to perform fully automated 3-D simulations in 5 to 15 minutes.
- NARAC desktop or laptop tools: NARAC provides *HotSpot* for simple radiological plume predictions. *NARAC iClient* software allows *HotSpot* or downloaded NARAC plume predictions to be saved and displayed on maps on a user's computer.
- 24-7 access to experts: NARAC experts provide 24-7 quality-assurance, detailed plume model analyses, plot interpretation and training. NARAC personnel have expertise in atmospheric dispersion, meteorology, numerical modeling, computer science, software engineering, geographical information systems, computer graphics, hazardous material (radiological, chemical, biological) properties, chemistry, and health physics.

Smoke plume photograph with NARAC-simulated smoke particles in red. (Photo courtesy of Tracy Press.)

Research and Development

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 event reconstruction
- Regional and urban field experiments

NARAC conducts research and development on atmospheric problems, such as dense gas dispersion around buildings and in complex terrain.

For More Information

- Web: *https://narac.llnl.gov*
- Program Leader Dr. Gayle Sugiyama: 925.422.7266, sugiyama@llnl.gov
- Deputy Program Leader Dr. John S. Nasstrom: 925.423.6738, jnasstrom@llnl.gov

D1301

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. The Department of Homeland Security sponsored part of the production of this material. LLNL-BR-437312