

Modeling Support for the TOPOFF 2 Exercise by the National Atmospheric Release Advisory Center (NARAC)

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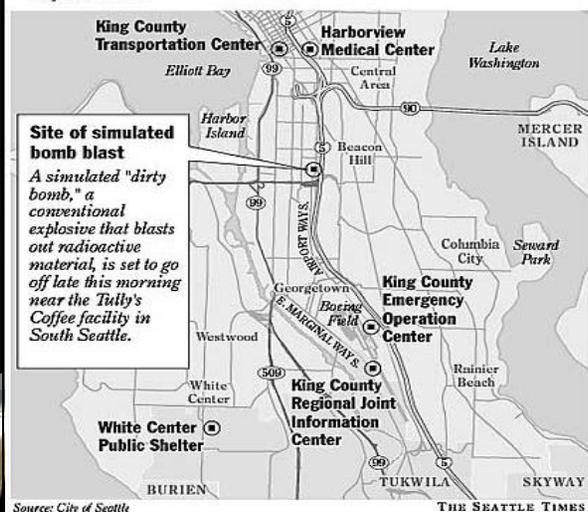
TOPOFF 2 Exercise Provided a Major Test of NARAC Support of Multiple Agencies

- Exercise on May 12-15, 2003 involved emergency personnel from the city, county, state and 19 federal agencies, including sponsoring agencies: DHS and DOS
- Largest domestic terrorism exercise undertaken since the terrorist attacks of September 11, 2001, and since the establishment of DHS
- NARAC predictions were used for the radiation dispersal device explosion in Seattle by 20 local, state and federal organizations



Topoff 2 disaster exercise

Today, as many as 18 city, county, state, federal and Canadian agencies will participate in one of the country's largest emergency disaster-response drills.

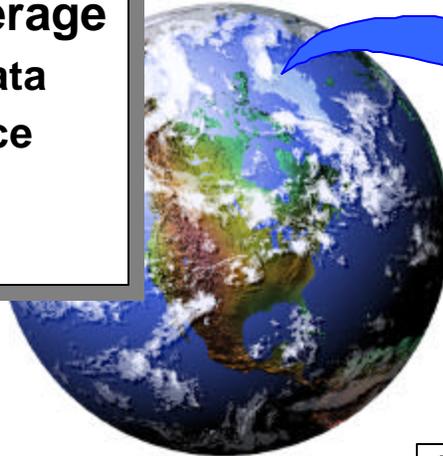


National Atmospheric Release Advisory Center (NARAC)

Real-time advisories for hazardous atmospheric releases

World-wide data coverage

- Real-time weather data
- Terrain & land surface
- Maps
- Population



National Center at LLNL

- Advanced, automated 3-D plume model responds anywhere in the world in real-time
- Scientific and technical staff provides training, assistance and analysis 24 hrs x 7 days

Real-time 3-D Plume Model Predictions

- Nuclear, radiological, chemical, biological releases
- Plume predictions available within minutes using Internet/Web tools
- Standalone simple plume modeling tools on end user's computer
- Geographical information displays
- Affected population, health risks, recommended actions





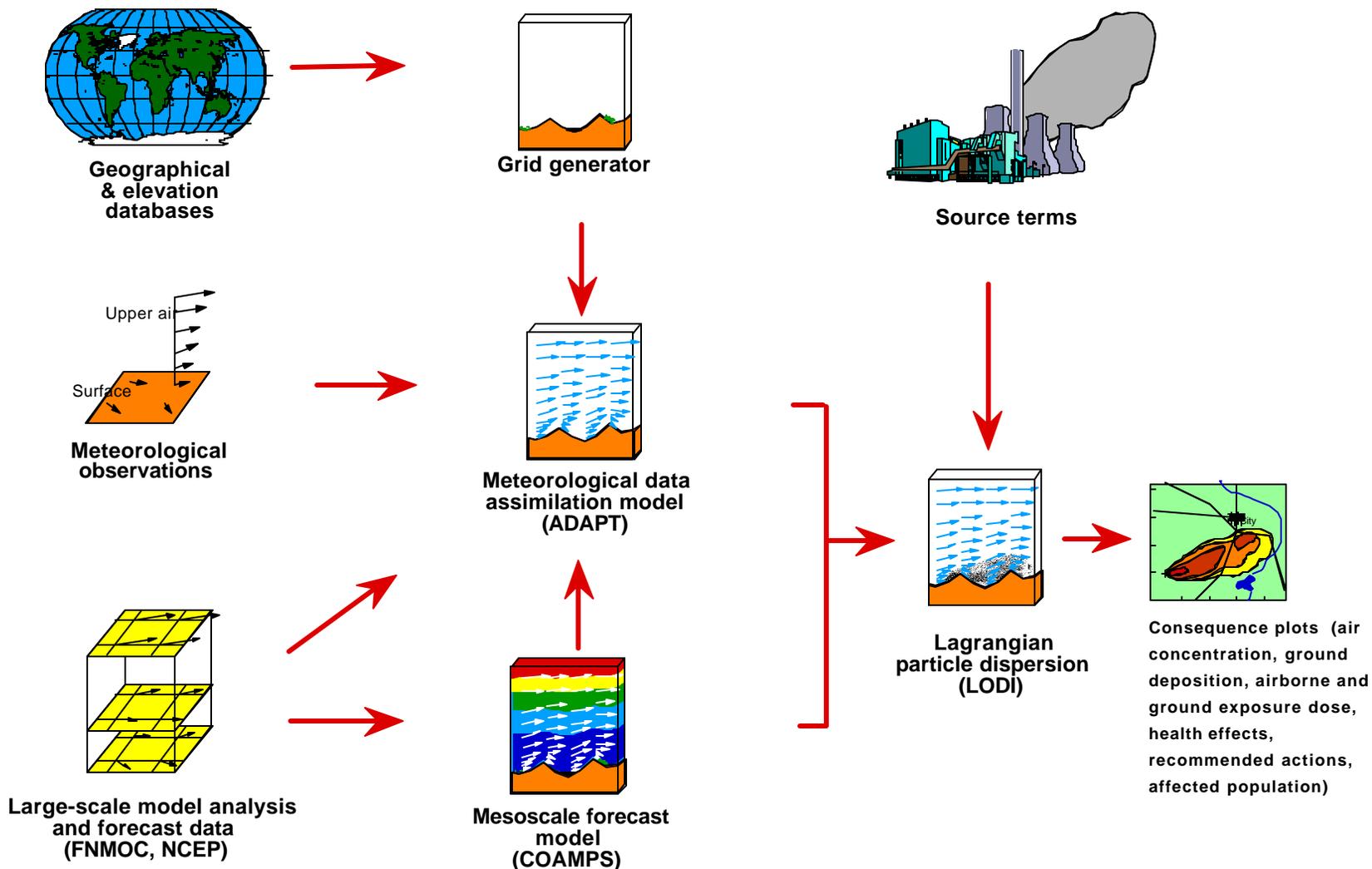
DOE/NNSA Radiological and Nuclear Modeling Tools

DOE/NNSA maintains tools and expertise developed by Lawrence Livermore National Laboratory's National Atmospheric Release Advisory Center (LLNL/NARAC) and Sandia National Laboratory (SNL) for assessing...

- Radiological & nuclear airborne source characteristics
- Prompt effects (blast, thermal)
- Meteorological flows
- Atmospheric dispersion and fallout
- Acute and chronic dose, affected population, injuries, casualties, and protective action guidelines



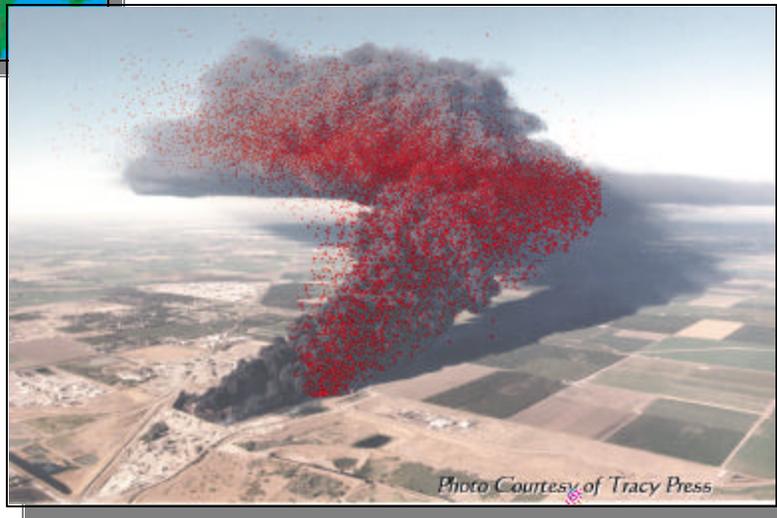
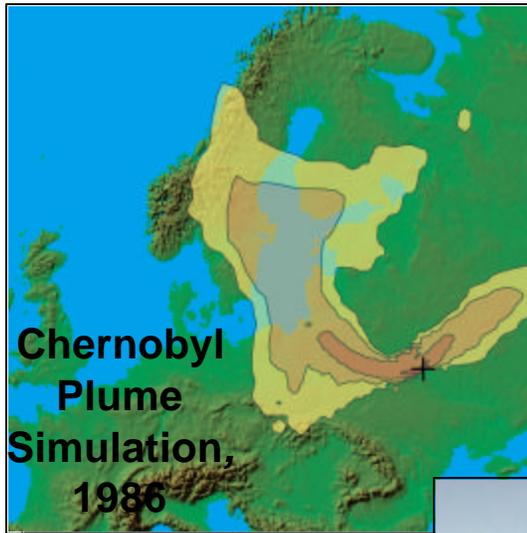
NARAC Modeling System



NARAC's modeling system is fully automated and relocatable anywhere in the world in real-time



Example NARAC Simulations



**NARAC Simulation (red) and Smoke Plume
Photograph, Tire Dump Fire, Tracy, California,
August 7, 1998**

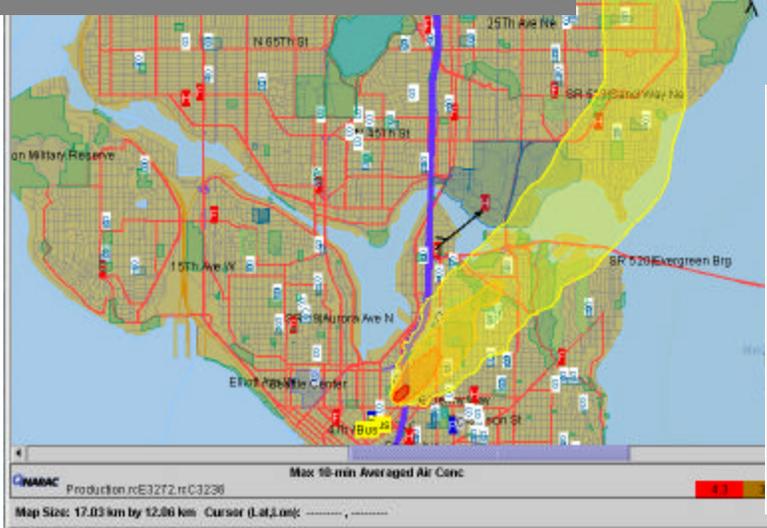
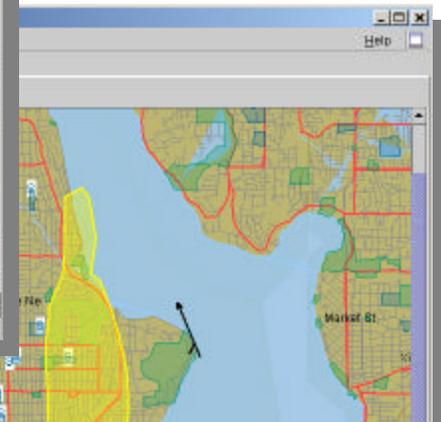
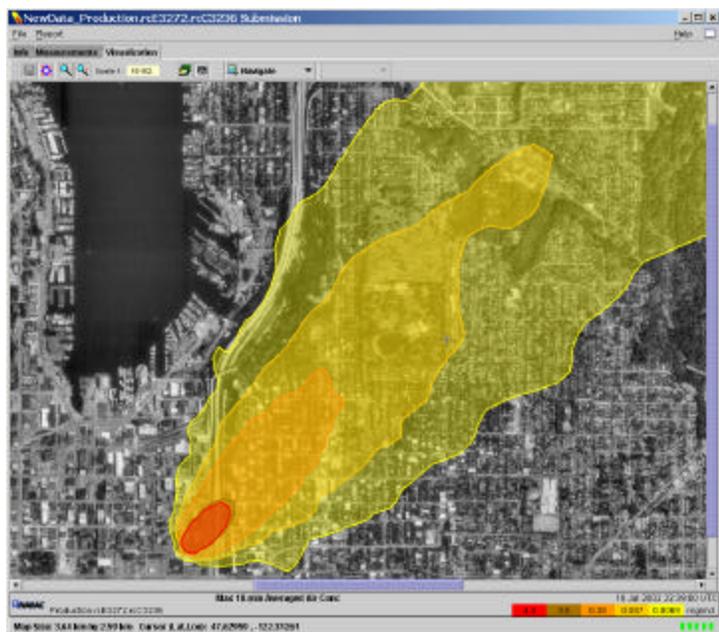
Example Responses

- Three-Mile Island
- Chernobyl
- Cerro Grande, NM Fire
- Chinese nuclear tests
- Richmond, CA chemical Cloud
- Desert Storm, Kuwait
- Mt. Pinatubo Volcano
- Tokaimura, Japan, Uranium accident
- Staten Island, NY Fire
- Post-September 11th Threats



NARAC Products

- Plume hazard areas
- Affected population counts
- Health effects
- Protective Action Guidelines
- Map features



Contours		
4.3 mg/m ³	Area: 0.038 sq km	Population: 30
85% of the exposed population could receive a lethal dose.		
3.5 mg/m ³	Area: 0.046 sq km	Population: 30
50% of the exposed population could receive a lethal dose.		
0.38 mg/m ³	Area: 0.378 sq km	Population: 3356
AEGL3: Exposed population could experience life-threatening effects.		
0.087 mg/m ³	Area: 1.450 sq km	Population: 7482
AEGL2: Population could experience serious long-lasting effects.		
0.0069 mg/m ³	Area: 15.249 sq km	Population: 33001
AEGL1: Exposed population could experience notable discomfort.		



Use of NARAC Products

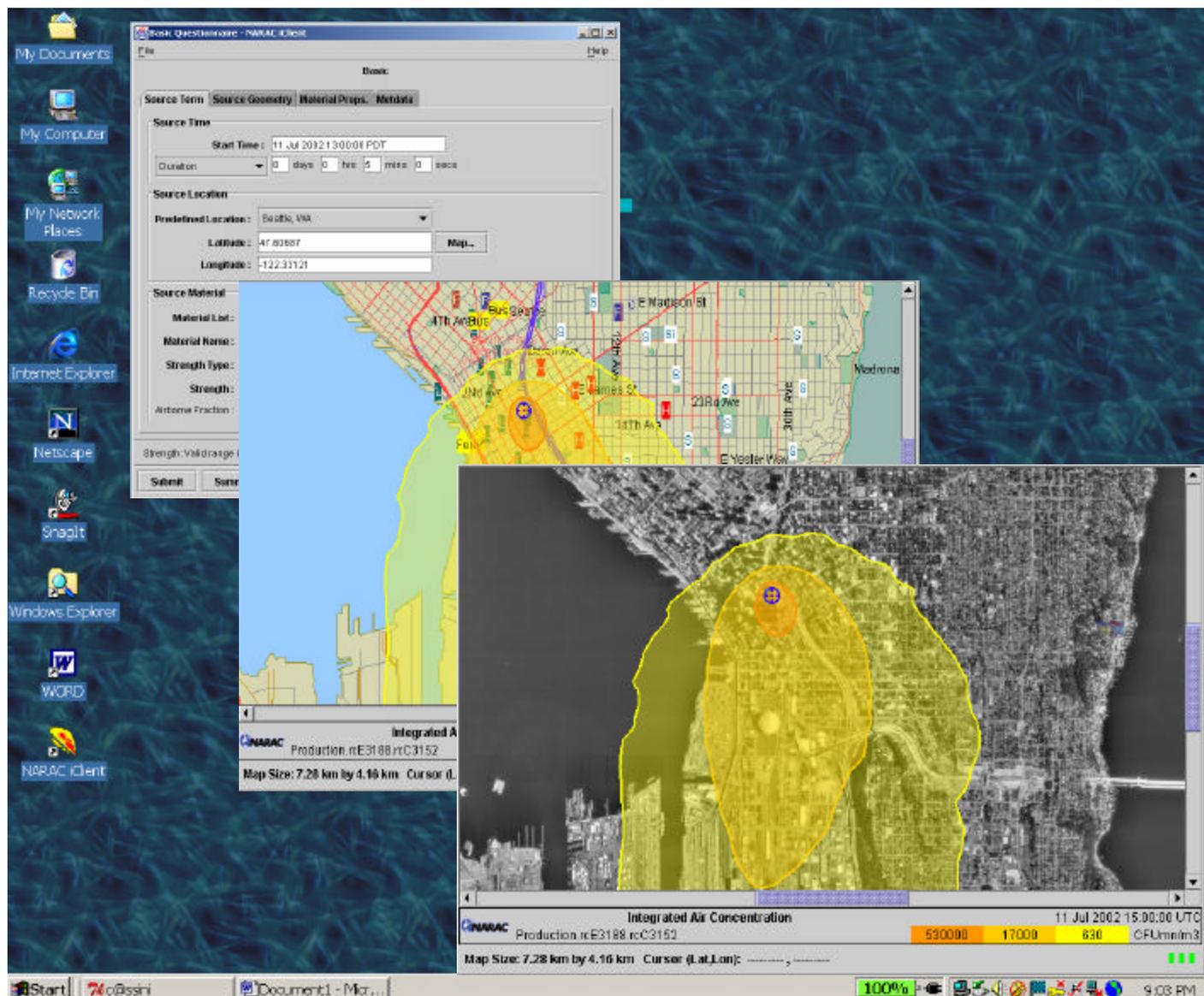
Tools for decisions on...

- Safe approach and evacuation routes
- Incident command site selection
- Use of personal protective equipment
- Deploying field monitoring teams
- Evacuation, sheltering and relocation
- Impacted emergency response and health services facilities
- Number of casualties and illnesses at hospitals
- Control of contaminated human food and animal feed



NARAC *iClient*. Java Software to Request and Display NARAC Plume Predictions

- Advanced tools to obtain detailed NARAC plume prediction data
- Real-time meteorological data
- Enter & display field measurement data
- Stand-alone capabilities: Simple Models and Detailed geographical data layers



Under the DHS LINC Program NARAC Provided Real-time Plume Predictions to Seattle Fire Department and Seattle EOC in TOPOFF 2



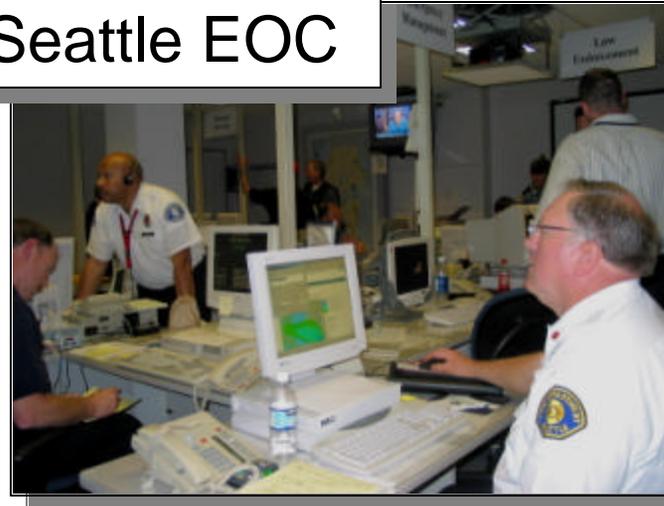
- Seattle Hazmat team and Incident Commander used wireless communication and laptop-based *NARAC iClient* software to access NARAC predictions
- Web-based distribution of NARAC plume predictions to Seattle Fire and EOC and other county, state and federal agencies in real-time
- Officials including the Mayor of Seattle, the DHS Secretary, and the President were briefed using NARAC predictions



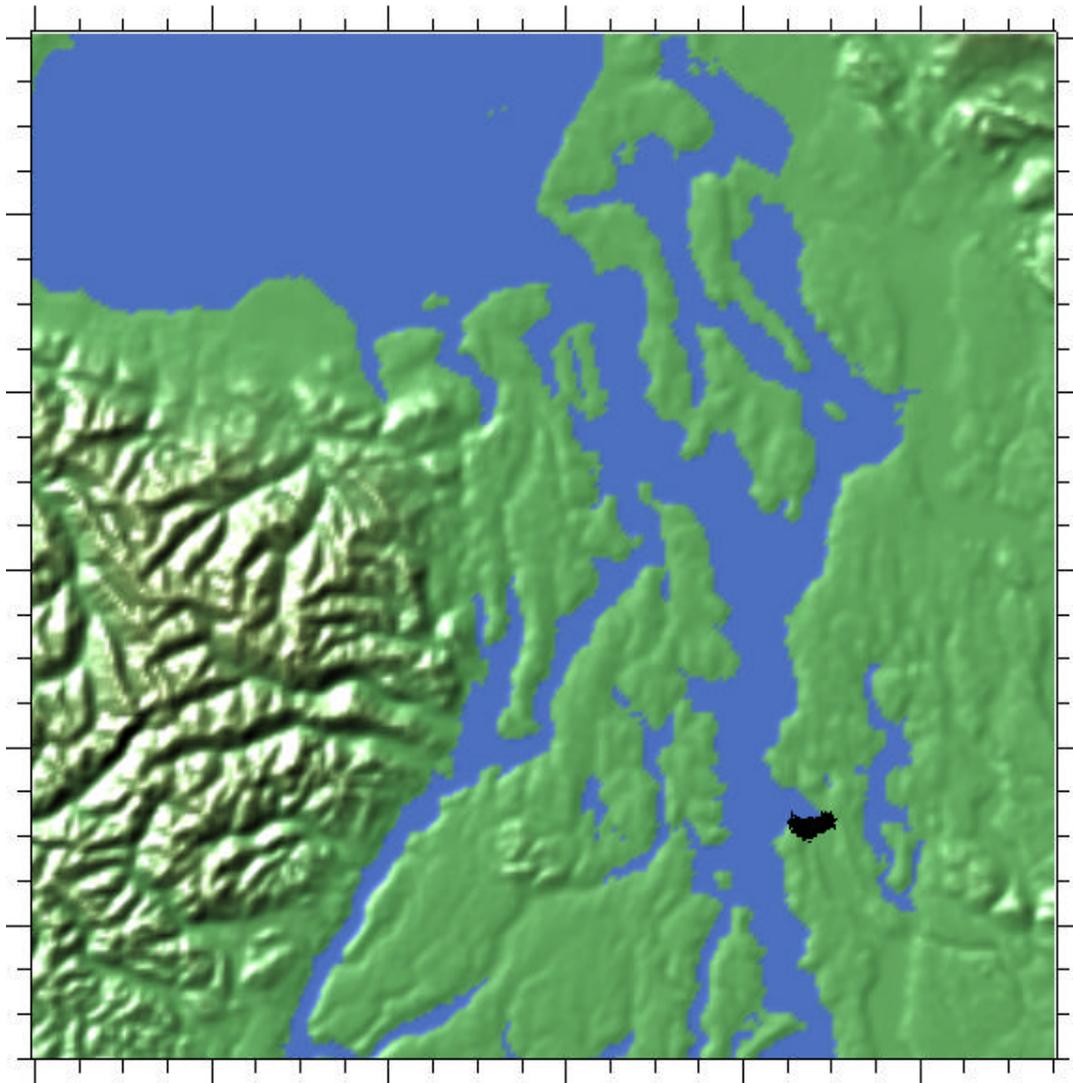
Seattle Fire Hazmat Team



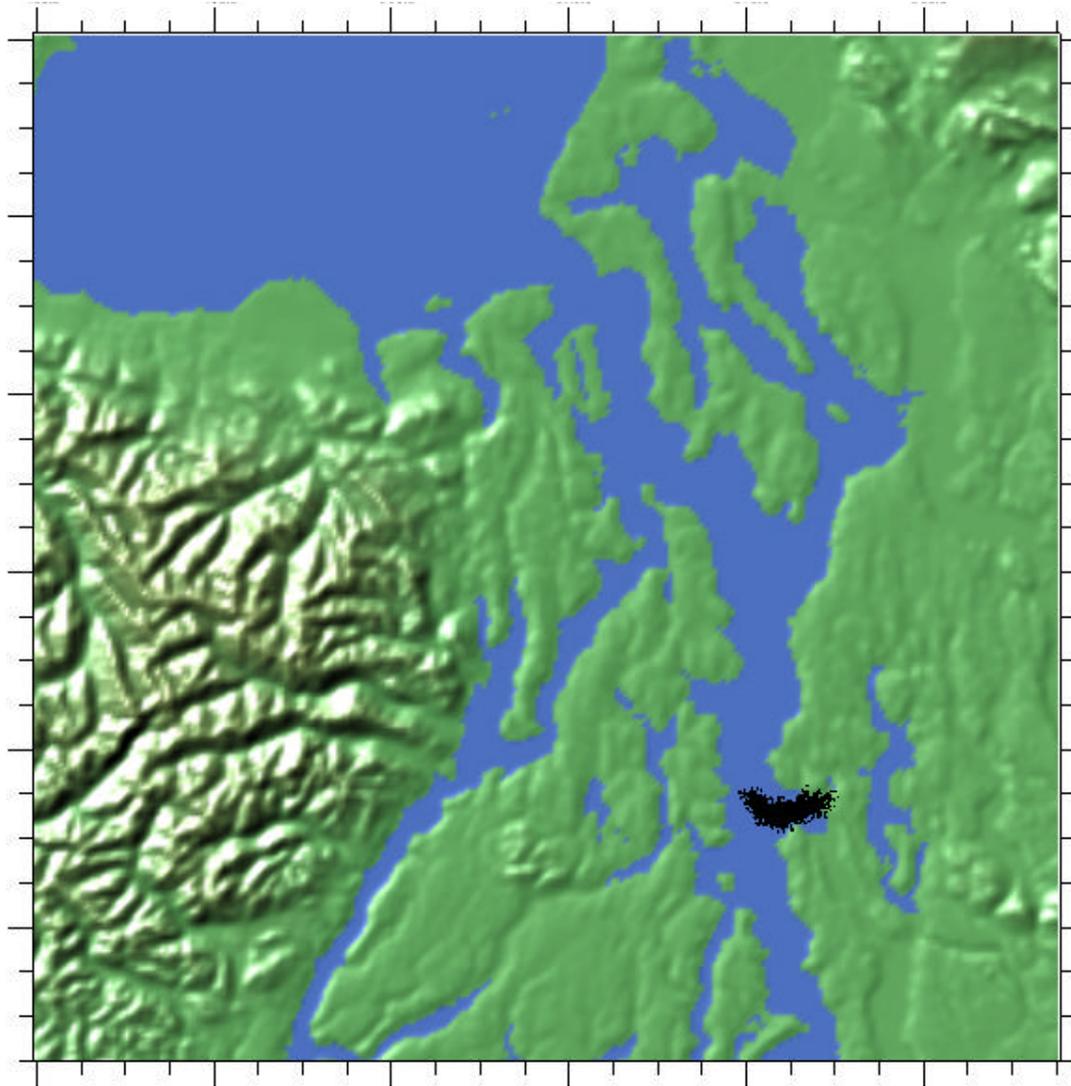
Seattle EOC



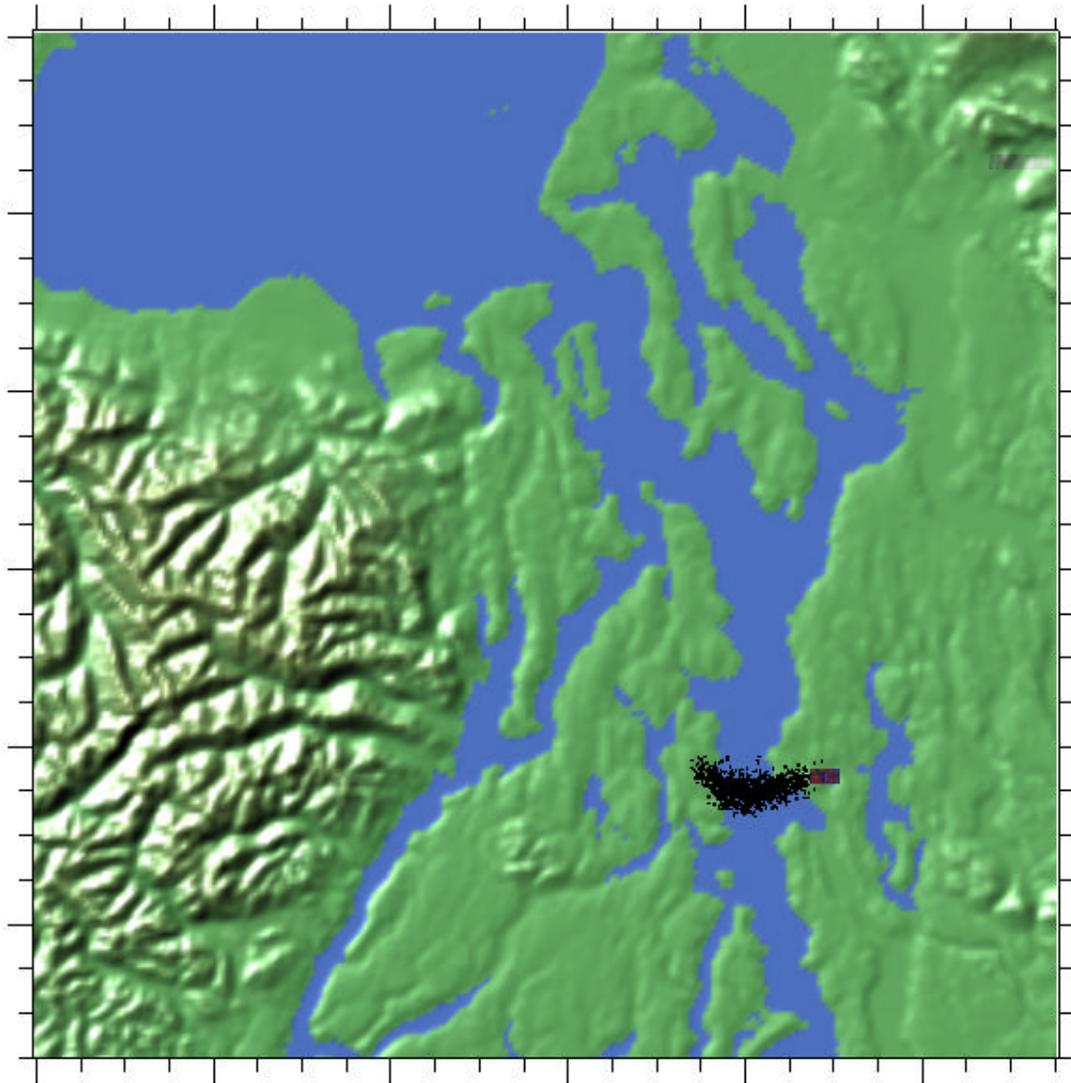
NARAC Simulation of Particle Cloud from Seattle Explosion



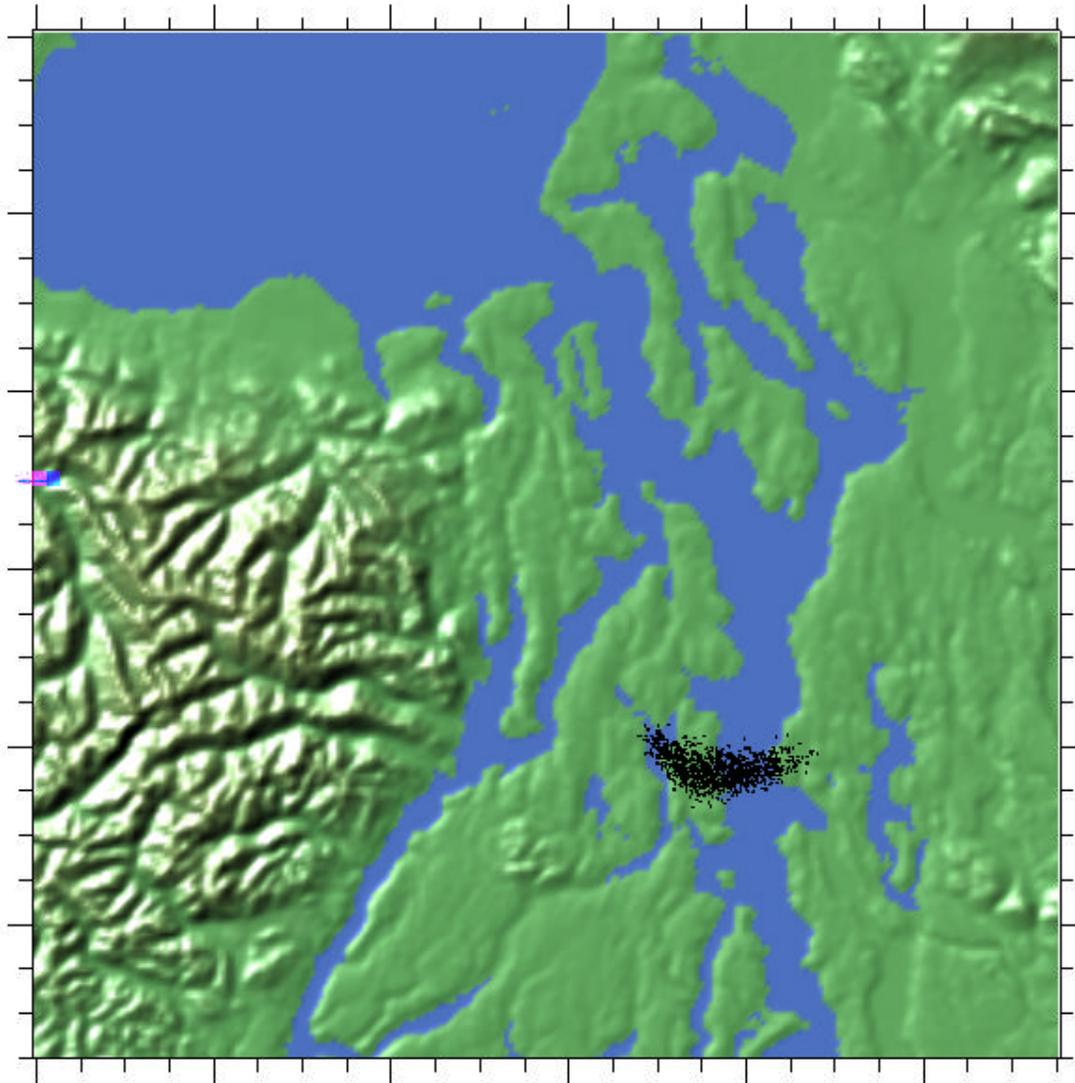
NARAC Simulation of Particle Cloud from Seattle Explosion



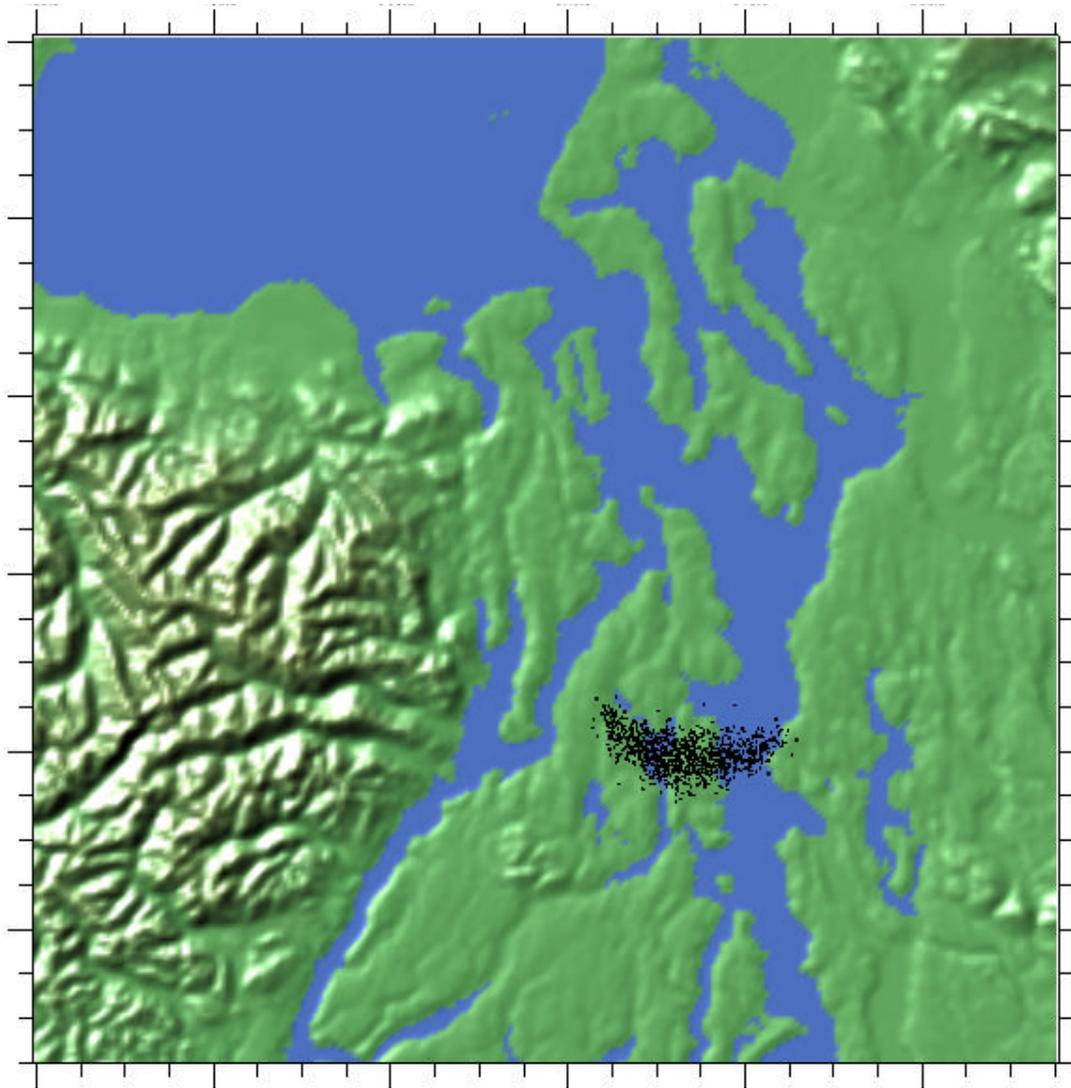
NARAC Simulation of Particle Cloud from Seattle Explosion



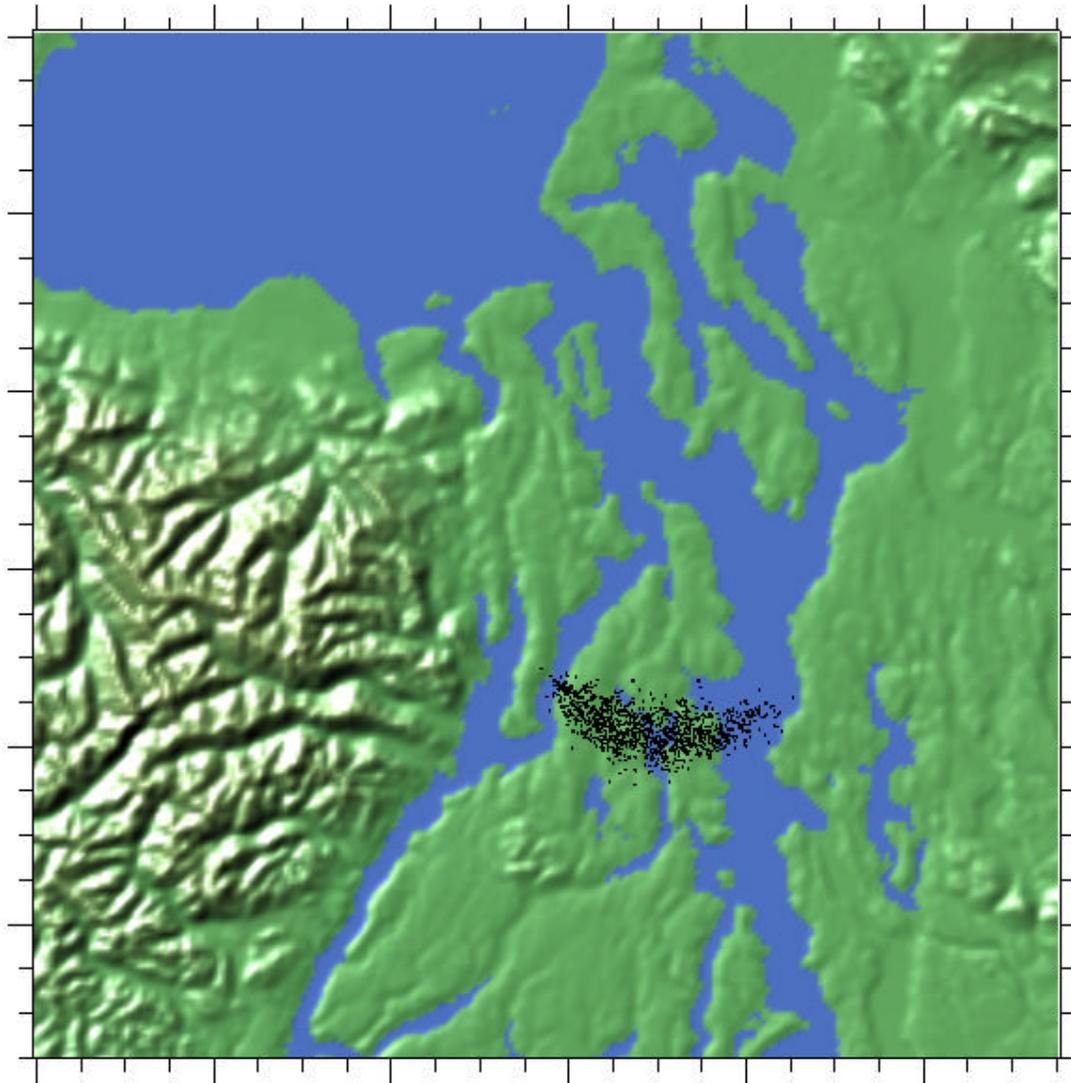
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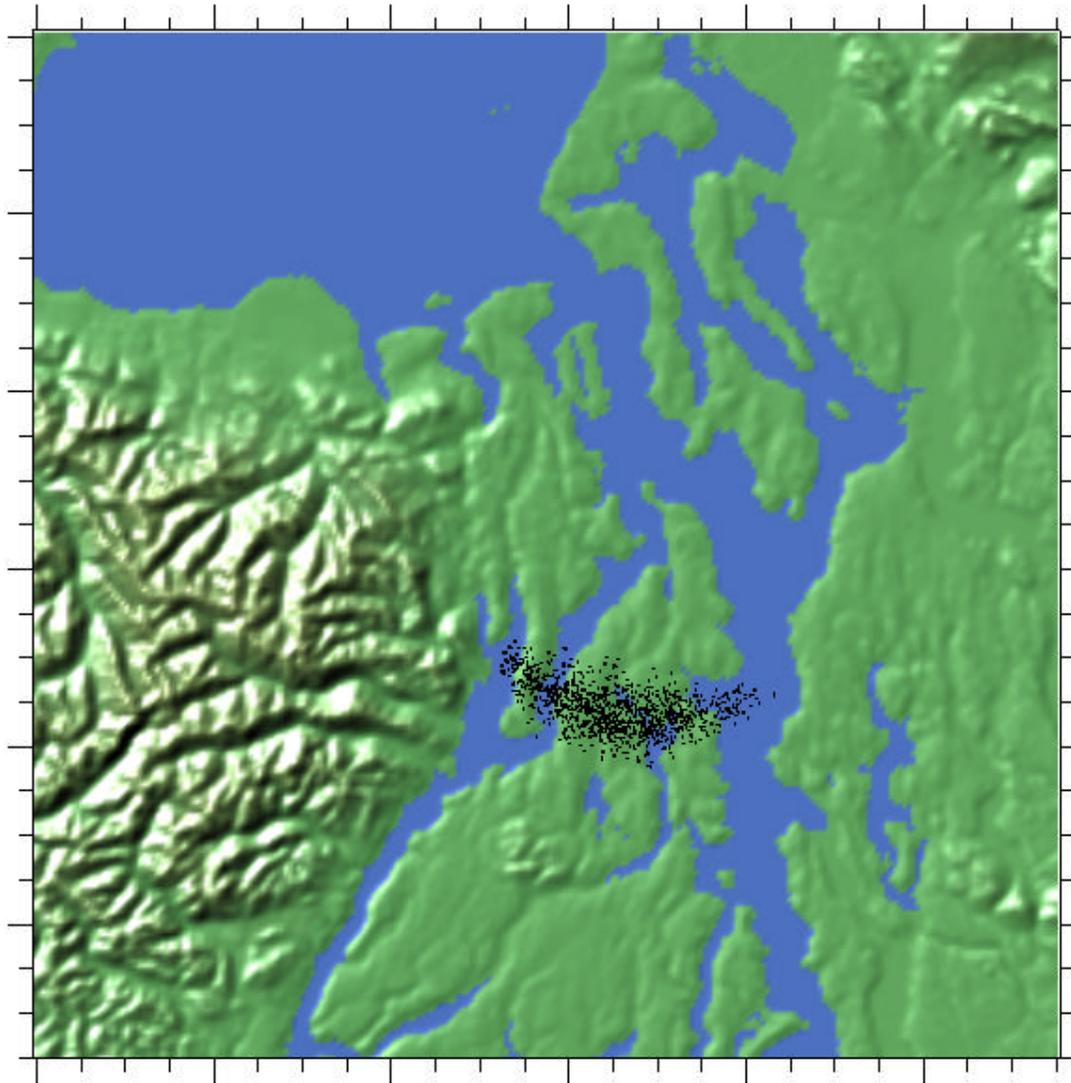
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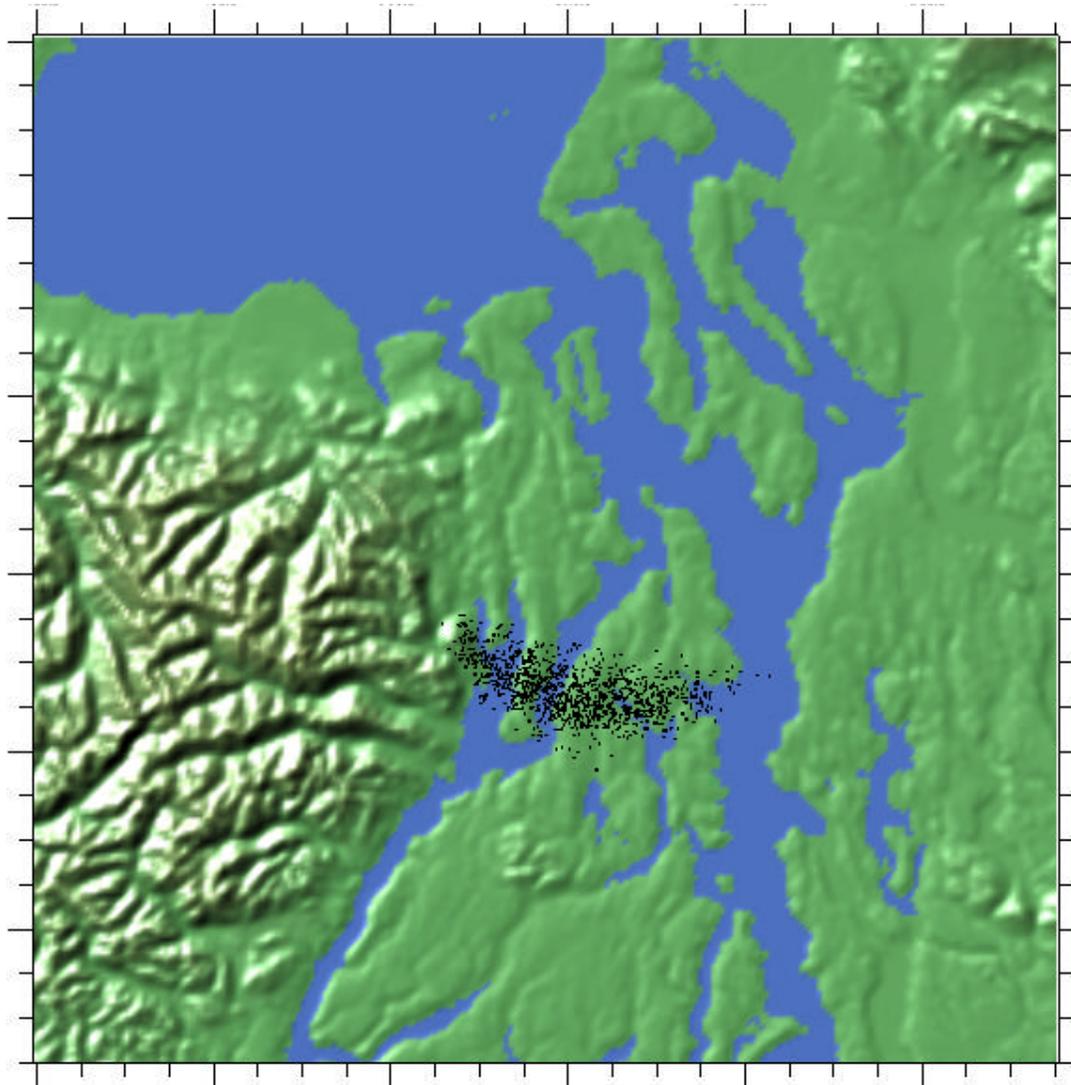
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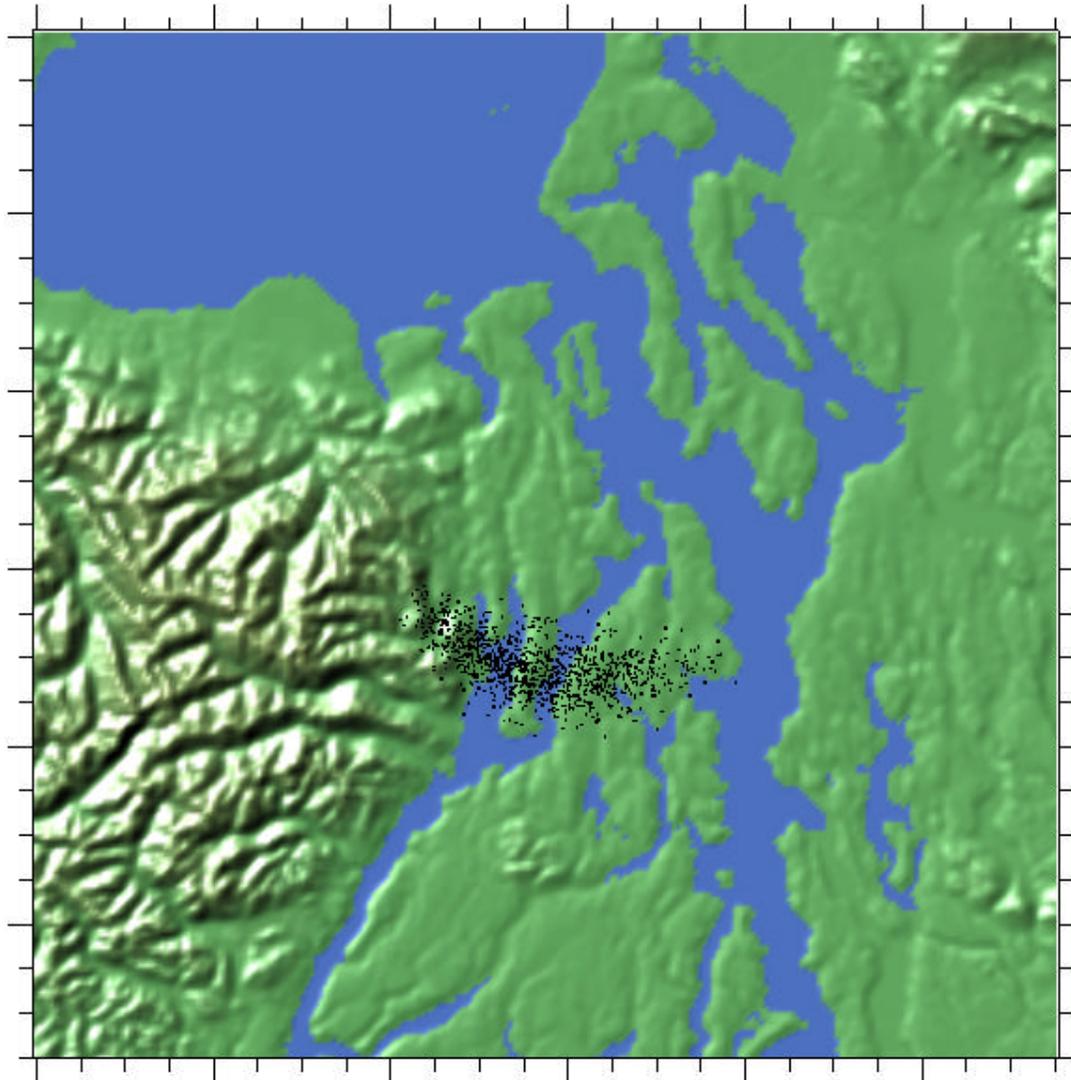
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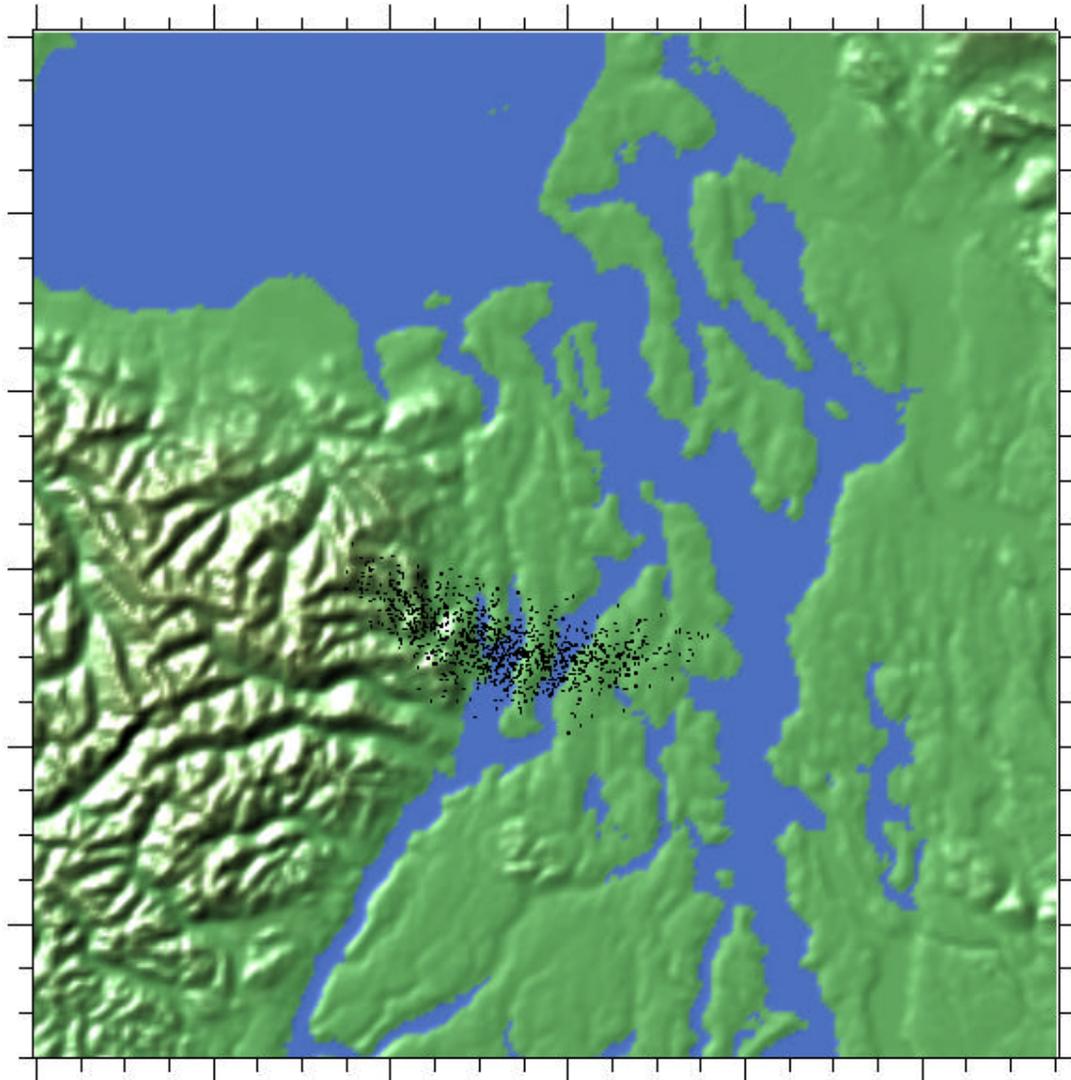
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NARAC Simulation of Particle Cloud from Seattle Explosion



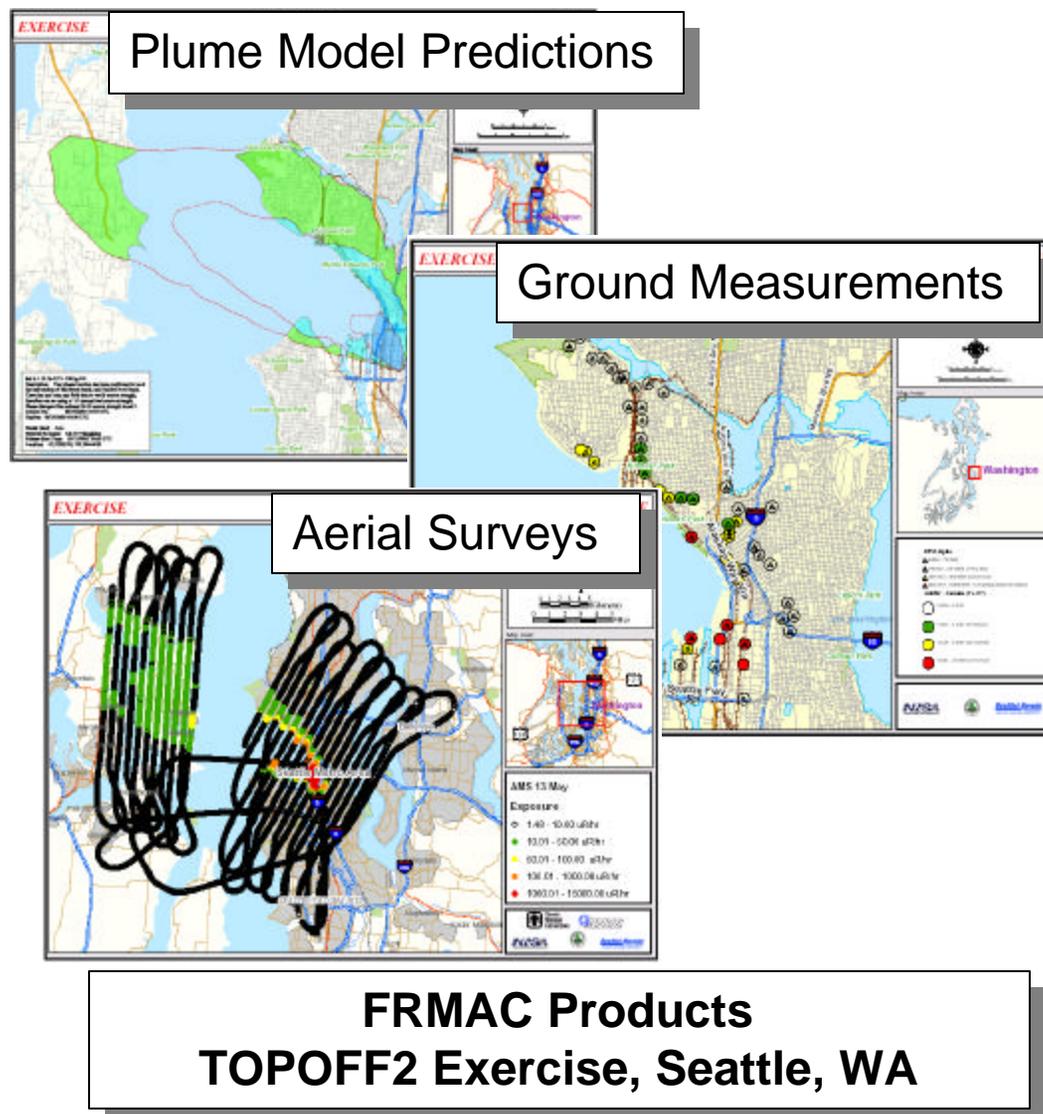
NARAC Simulation of Particle Cloud from Seattle Explosion



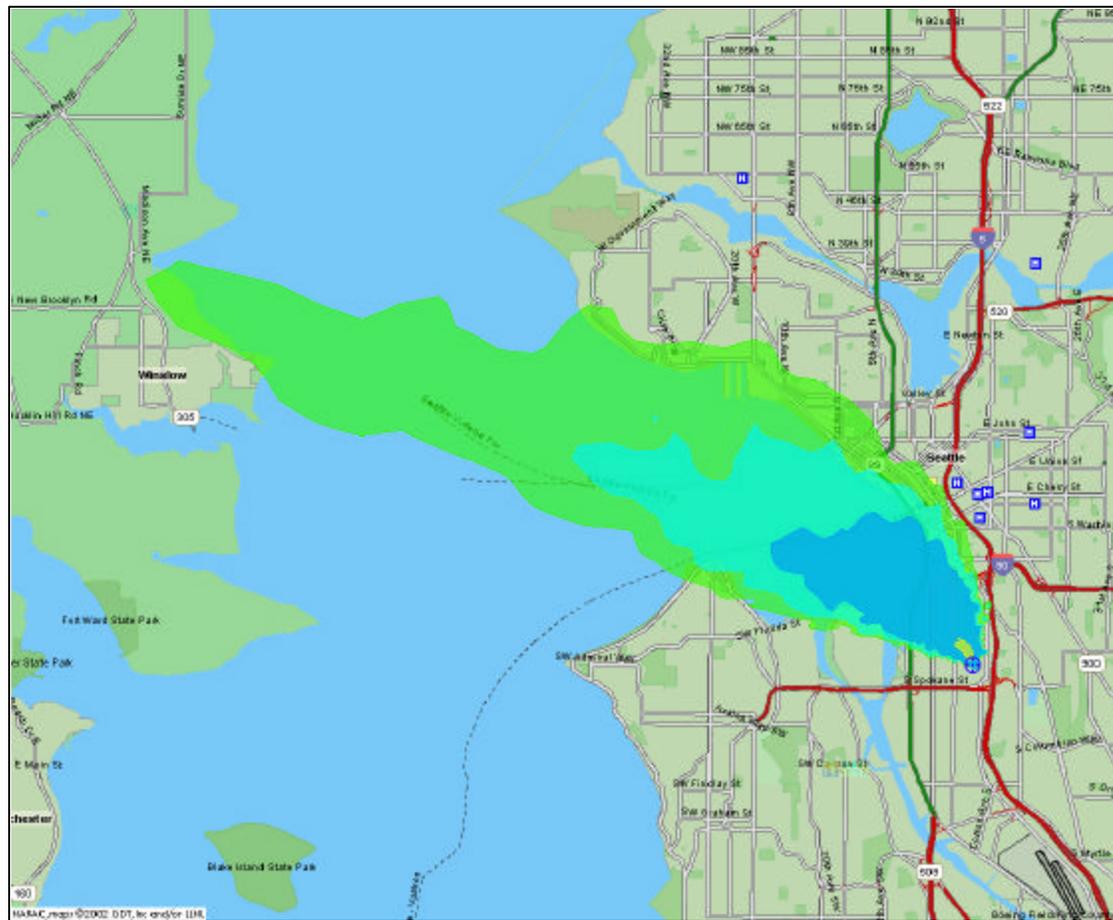
NARAC Provided Support to DOE Nuclear Incident Response Teams (NIRT), and to Local, State and Federal through the FRMAC



- NARAC provided critical support to the Federal Radiological Monitoring and Assessment Center (FRMAC) that produced protective action guidelines based on model predictions, field monitoring and Aerial Measurement System (AMS) surveys
- Predictions were distributed to local, state and federal agencies via NARAC Web and FRMAC GIS



FRMAC Measurement Data and NARAC Simulations Were Used to Define EPA Protective Action Guidelines: Evacuation and Relocation Areas

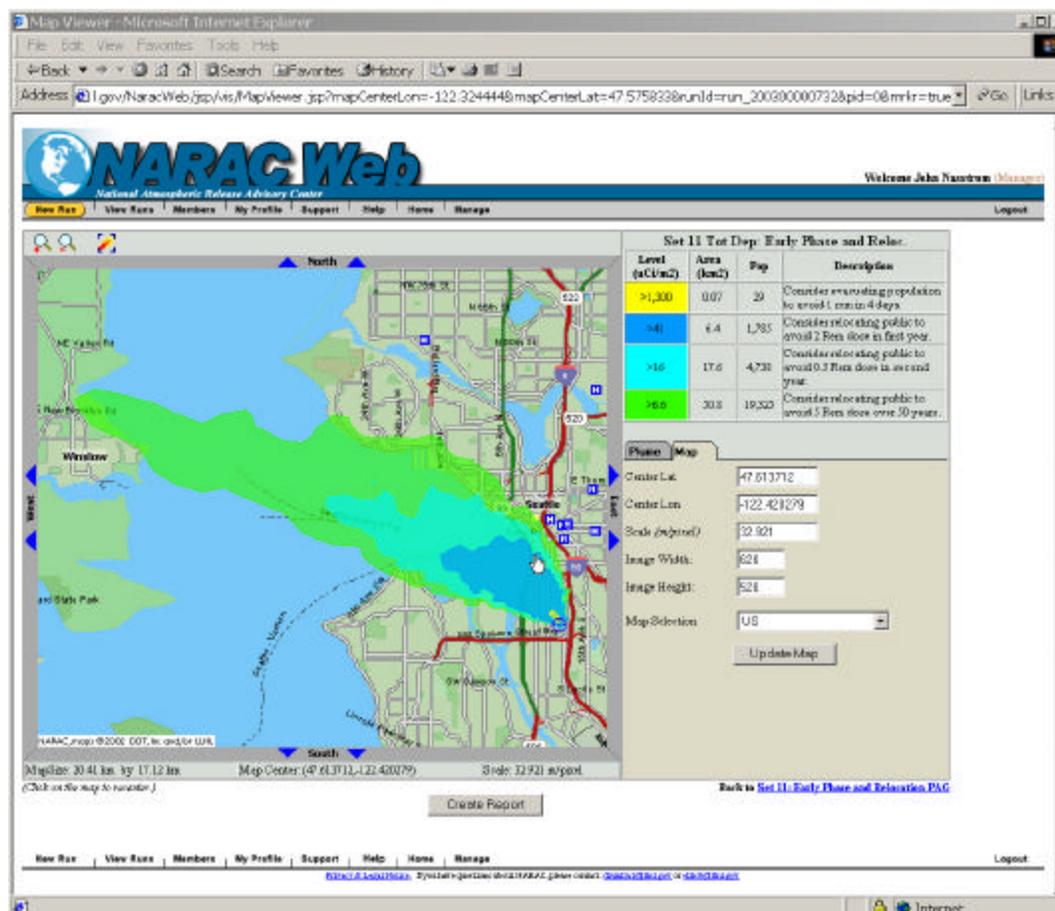


Level (uCi/m ²)	Area (km ²)	Pop	Description
>1,300	0.07	29	Consider evacuating population to avoid 1 rem in 4 days.
>41	6.4	1,785	Consider relocating public to avoid 2 Rem dose in first year.
>16	17.6	4,738	Consider relocating public to avoid 0.5 Rem dose in second year.
>6.6	50.8	19,325	Consider relocating public to avoid 5 Rem dose over 50 years.



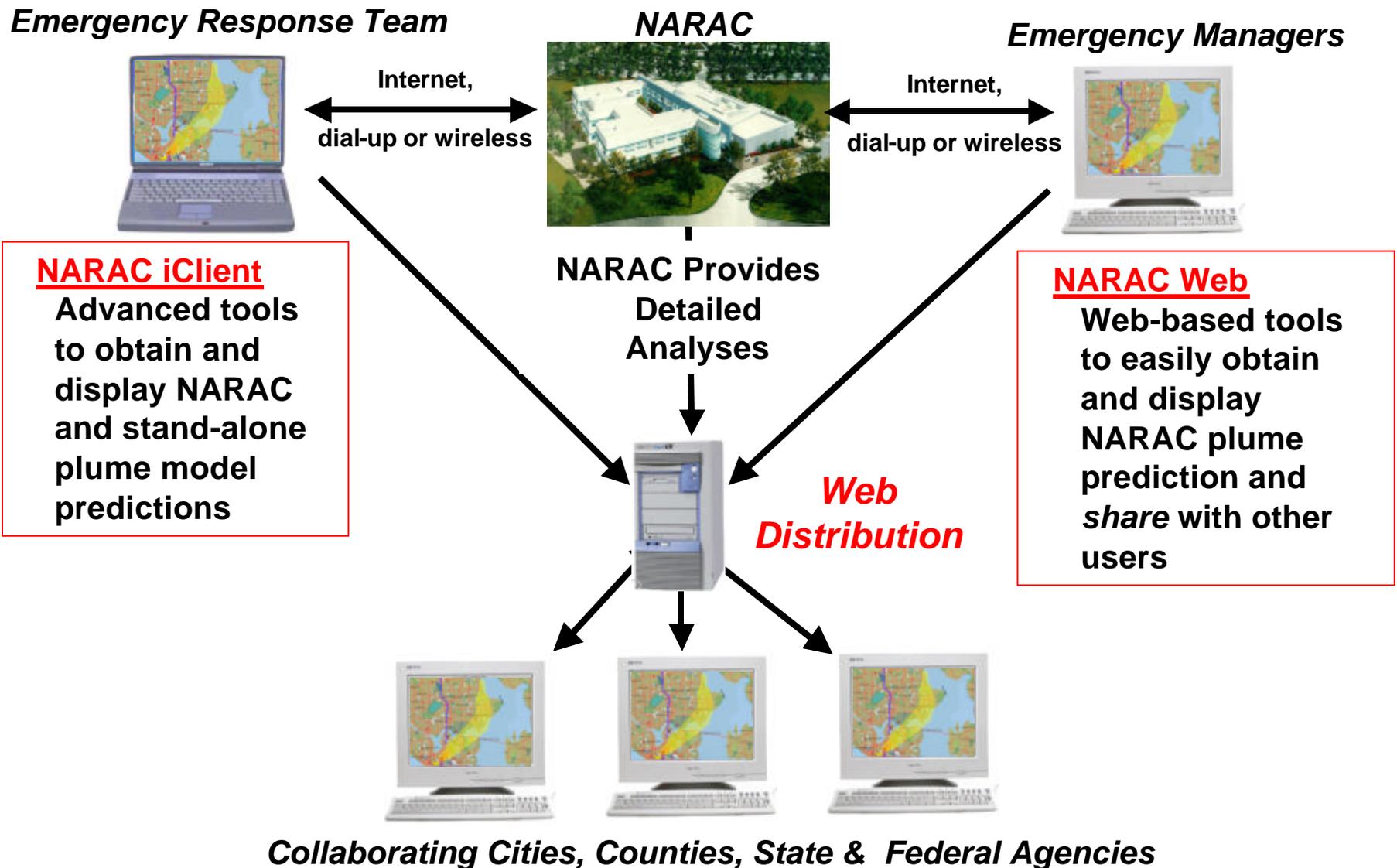
NARAC Web Provided Distribution of Plume Predictions During TOPOFF 2

- 20 local, state and federal organizations viewed predictions
- 35,000 hits on NARAC Web site during TOPOFF2 exercise
- User access requires Web browser and user name/password
- U.S.-wide high-resolution maps
- High-level of security and encryption (password controlled access)
- Plume predictions exported to GIS of other agencies





Internet- and Web-based Tools for Obtaining and Distributing Plume Model Products





Conclusions from TOPOFF2 NARAC Experience

- Plume modeling tools can be invaluable for...
 - Quickly mapping potentially affected areas
 - Guiding deployment of emergency response and field monitoring teams
 - Predicting health risks, evacuation and relocation zones using measurement data integrated with model predictions
- Deployable laptop-based plume modeling software system can provide critical early information for Incident Commander
- Web-based tools greatly aid information sharing with emergency managers and multiple local, state and federal agencies



Conclusions from TOPOFF2 NARAC Experience (cont.)

- Multiple communications options must be available (Web, Email, dial up, wireless, fax)
- Need pre defined sets of scenarios to use when minimal information available (typical of terrorism event)
- Need to develop faster incorporation of field monitoring data to update plume predictions for unknown/terrorist sources



Conclusions from TOPOFF2 NARAC Experience (cont.)

- Plume predictions and measurement data products need complete descriptions to facilitate interpretation and understanding of products
 - Assumptions and input data used (model prediction assumptions, measurement data)
 - Background material (interpretation guides, definition of terms)
 - Approving agencies and officials
 - Date/time issued
- Appropriate level of training and education on plume predictions and measurement data products is important for both subject matter experts and decision makers



Conclusions from TOPOFF2 NARAC Experience (cont.)

- Coordination and communication of plume model predictions and measurement data products was a challenge → Efforts are ongoing to improve
- Exercise artificialities (e.g., limited hours of operation, limited staffing) contributed to many TOPOFF2 challenges