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LLNL Support for the National Atmospheric Release Advisory Center (NARAC) and Interagency Modeling and Atmospheric Assessment Center (IMAAC)

Ron Baskett
NARAC-IMAAC Program
NARAC-IMAAC Provides Consequence Management Tools, Services & Products

Event information
- Weather data
- Nuclear, radiological, chemical, biological source information
- Sensor data

Plume Models and Expertise
- Advanced, automated 3-D plume modeling anywhere in real-time
- Scientific and technical staff provides training/assistance and detailed analysis 24 hrs x 7 days

Incident Management Information
- Health effects, exposed population and facilities
- Casualty/fatality/damage estimates
- Response strategies
- Protective action recommendations
- Geographical information

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Access to world-wide weather data and geographical information:
- Observed & forecast weather data
- Terrain & land surface
- Maps
- Population

National Atmospheric Release Advisory Center (NARAC):
- Computer systems for 3-D plume simulations
- Un-interruptible, backup power
- 24x7 scientific & technical support

Automated real-time 3-D plume model predictions for nuclear, radiological, chemical or biological releases available in minutes from national center using Internet/Web tools
- Standalone simple plume modeling tools for end-user’s computer require no connection to NARAC
Component-based LLNL NARAC-IMAAC Computer Systems Support In-house and External Users

External Users

- NARAC Web
- NARAC iClient

Internet/Dialup

Remote Access System

LLNL In-house Advanced User Environment

Central System

- Weather Data
- Geographic Data
- Models

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NARAC’s Central Modeling System Provides Automated 3-D Plume Model Predictions

NARAC’s modeling system is fully automated and works for any location in the world in real-time.
Global Meteorological Data Acquisition

- Over one million meteorological observations per day from around the world are collected and stored by NARAC.
- Weather forecast model predictions from global and regional models are continuously collected from the U.S. National Weather Service and the U.S. Navy.
- Special meteorological observation networks supplement global and regional data collected routinely by NARAC.
- NARAC meteorologists analyze quality of data.
- Users can view maps and tables of wind data.

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IMAAC/NARAC Inter-Agency Response to Conyers, GA Chemical Plant Fire

- 250,000 lbs of chlorine compounds burned over a two-day period (May 25-26, 2004)
- Current conditions and forecasts
- Plume predictions refined with EPA field measurements
- IMAAC/NARAC products used by Federal (DHS, DOE, EPA), state of Georgia, and local officials to guide:
  - Location of incident command sites
  - Safe approach routes
  - Sheltering and Evacuation areas
  - Guiding sampling teams
Case Study: Hypothetical RDD in Salt Lake City Winter Olympics 2002

Jan. 30, 2002 Early morning light near-surface winds show cold air drainage flow down slopes & towards the Great Salt Lake

Mesonet Surface Wind Observations

Jan. 30, 2002 Early morning light near-surface winds show cold air drainage flow down slopes & towards the Great Salt Lake
Case Study: Hypothetical RDD in Salt Lake City – NARAC ADAPT 3-D Model Surface Winds

Jan. 30, 2002
Early morning light near-surface winds show cold air drainage flow down slopes & towards the Great Salt Lake

High-explosive Detonation Point
Stronger Upper-level winds from the north
Case Study: Hypothetical RDD in Salt Lake City – NARAC LODI 3-D Model
Particle Dispersion Simulation

Red particles show LLNL NARAC ADAPT/LODI dispersion simulation using SNL ERAD explosive source characteristics (particle size distribution and spatial distribution of mass from surface to several hundred meters above ground) — Simulation begins at 05:00 MST (ends at 11:00 MST)
Upper level cloud transported southward

Lower level cloud transported northward by surface winds

Note: Increase mixing begins as daytime heating of surface occurs
Case Study: Hypothetical RDD in Salt Lake City – NARAC LODI 3-D Model Particle Dispersion Simulation
Case Study: Hypothetical RDD Ground-level Time-integrated Dose

Detonation Point

Northward transport due to surface winds

Fumigation (downward mixing of upper level cloud) after sunrise
Redundant Weather Services Provide Automated Meteorological Data

NOAA National Weather Service
(observational data, gridded analyses & forecast data)

AFWA
Air Force Weather Agency
(observational data, gridded analyses & forecast data)

LLNL

FNMOC
Fleet Numerical Meteorological and Oceanographic Center
(gridded analyses & forecast data)

Supported Sites
Navy Facilities
(tower data)

Other Supplementary Networks
Kennedy Space Center
MESOWEST
AWS

Internet
Dial-up line
Satellite
Extensive Geospatial Databases Underlie Assessments

- **Terrain Elevation** is used for the lower boundary of 3-D meteorological flow and dispersion models.
- **Urban and Rural Land Characteristics** are used to model their effects on wind and turbulence.
- **Population Density** is used to estimate the population affected by the plume.

**Global coverage**
- NGDC 10km
- USGS 1km
- NIMA DTED (1km, 100m, and 30m)

**U.S. coverage**
- USGS DEM 30m
- USGS 200m LULC
- USGS 30m NLCD
- NGA/SAIC US 3D building data
- LBNL US building air infiltration data

**Global coverage**
- ORNL 1km GLCC

**U.S. coverage**
- ORNL LandScanUSA day-night population
- Census Bureau population
LandScanUSA High-resolution Day-night Population Database from DHS/ORNL Integrated Into NARAC/IMAAC Model Calculations

Daytime Population Density New York City Area

Nighttime Population Density New York City Area

Oak Ridge National Laboratory LandScanUSA day-night population data provided by DHS/Office of Infrastructure Protection/Infrastructure Information Collection Division
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Web tools
Automated reach-back to plume modeling with real-time weather data

Sharing of predictions with other users or groups of users through IMAAC/NARAC Web

Output formats
- GIS Shape files
- PDF
- HTML/XML
- PowerPoint
- JPG/PNG graphics
- Consequence reports

iClient: Stand-alone capabilities: Simple Models and geographical information displays
NARAC Web Login
(see https://narac.llnl.gov)

Providing emergency managers with browser based access to NARAC

Authorized users of this system can:
- Enter a simplified description of an atmospheric release.
- Send this information to NARAC for processing.
- Receive an initial prediction, based upon NARAC's sophisticated 3-D model, within 5 to 10 minutes.
- Share the prediction with other authorized users.

For emergencies only, you can alternately reach NARAC at (925) 424-6465

If you are an emergency manager without an authorized login or would prefer to talk to someone directly, you can contact NARAC at (925) 424-6465. Between 7:30 AM to 4:15 PM Pacific Time, Monday-Friday, this call will put you in direct contact with one of our trained operations staff members who will assist you in answering questions to determine the nature and severity of the incident. At all other times, your call will be answered by LLNL's emergency duty officer, who will forward your request to our on-call staff.

NARAC Web Capabilities

This is an Initial Operational Version of the NARAC Web System. Enhancements will continue to be made as the system matures. This version contains the following features:
- Security - user login/password, encrypted [https] communications
- Ability to specify a predefined release location [site], or select a location from a map.
- Output in the form of a non-pdf standard NARAC HTML Report
- Ability to initiate a run and come back later to view it.
- Ability to delete previously created runs.
- High level state, regional and local maps, including interstates, major highways, local streets political boundaries, water, major landmarks, etc.
- Ability to share runs with other NARAC Web users.

How To Become a Registered User

During this Initial Operational Period, we must regretfully limit access to a select group of registered users. Once the system becomes fully operational, additional registered users will be added on a regular basis. We are still working out the details of exactly how new users will be validated and added to the system. If you are an emergency manager at any level of local, state, regional or federal government with a legitimate need to access this system, then NARAC would like to hear from you. Please fill out the account request and someone will contact you with details and a timetable for becoming a registered user.
NARAC Web:

Notifications of new NARAC predictions and updates will be sent by email and posted to the HOME page.
NARAC Web:
Select predefined or user-defined radiological, nuclear, chemical, and biological airborne release scenario
NARAC Web: Enter Airborne Source Information
NARAC Web:
Location may be chosen by map or address look-up.
**NARAC Web:**

Display plume model results
- Plume hazard areas
- Predicted health effects
- Affected population counts
- Geographical information (maps, aerial photographs, facilities of interest)
- Export formats: GIS shapefiles, PDF, Powerpoint, JPEG

Plume models run automatically for any location in country using NARAC 3-D atmospheric flow, transport and deposition models.
NARAC Scientists can use sampler data to refine plume model predictions and reconstruct events.
NARAC Web:
Easily share plume model results with other authorized users
Select individual users and/or groups of users to share plume model results with others.
For more information see
http://narac.llnl.gov
Guidebooks and Training Material

- Model technical manuals
- Web-based training
- Step-by-step guide to software use
- Guide books for determining model inputs from known information
Standardization of NARAC and EPA/NOAA CAMEO/ALOHA Databases and Products Make National Tools More Complementary

- Completed standardization of hazard levels and color for both ALOHA v5.3 and NARAC plume modeling results
  
  **Red**: life threatening effects (AEGL3, ERPG3 or TEEL3)
  
  **Orange**: serious long-lasting effects (AEGL2, ERPG2 or TEEL2)
  
  **Yellow**: notable discomfort (AEGL1, ERPG1 or TEEL1)

- Chemical properties database standardized between CAMEO/ALOHA and NARAC

- Design of Software interface between CAMEO/ALOHA and NARAC iClient

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AEGL: EPA Acute Emergency Guideline Level  
ERPG: American Industrial Hygiene Association (AIHA) Emergency Response Planning Guideline  
TEEL: DOE Subcommittee on Consequence Assessment & Protective Actions (SCAPA) Temporary Emergency Exposure Limits