Radiological Consequence Management

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Mission

Protect the public, environment, and the emergency responders by providing a responsive, flexible, efficient, and effective radiological emergency response framework and capability for the Nation

Outline

- Policy / Authorities
- Response Structure
- Consequence Management (CM) Response Teams (DOE/NNSA)
  - Technical Capabilities
  - Products
- Current Initiatives

Role of the Department of Homeland Security

- National Response Plan (NRP) effective January 2005.
- DHS is responsible for overall coordination of response for Incidence of National Significance (INS)

NRP Nuclear Radiological Incident Annex

- Defines Roles and Responsibilities for Federal agencies for INS and other Radiological Incidents.
- Coordinating Agencies Lead Technical Response
  - DOE, DOD, NASA, NRC, EPA
- Cooperating Agencies Assist Coordinating Agencies in Response
- DOE coordinates radiological monitoring and assessment activities for the initial phases regardless of who is the Coordinating Agency

Advisory Team

- Provides advice on environment, food and health matters to the state and Coordinating agency.
- Representatives from:
  - EPA – Evacuation / Shelter in place guidance (EPA400)
  - HHS – FDA guidance on contamination in food
  - USDA
  - Other Cooperating Agencies as warranted by the incident.

U.S. Department of Energy

- Energy Assurance, Office of Science, OCRWM, etc.
- National Nuclear Security Administration
  - Stockpile Stewardship
  - Nuclear Nonproliferation
  - Naval Reactors
  - Office of Emergency Management
    - DOE Site Emergency Management
    - Office of Emergency Response (NA-42)
      - Crisis Response
      - Consequence Management

Office of Emergency Response

- Expert technical advice from the DOE complex in response to:
  - Nuclear weapon accidents and significant incidents
  - Radiological accidents
  - Lost or stolen radioactive materials
  - Acts of nuclear terrorism
- Provide access to expertise in nuclear weapons design and production capabilities
- Deployable capabilities, configured for a rapid response to any specific nuclear accident or incident

Department of Energy's Radiological Response Assets

NARAC
National Atmospheric Release Advisory Capability
Computer Modeling of Transport Diffusion and Disposition of Radioactive and Hazardous Material

RAP
Radiological Assistance Program
Radiological measurements and advice to public sector

AMS
Aerial Measurement System
Airborne radiological sensing and surveying capabilities

Consequence Management

CMRT
Consequence Management Response Team
Operational and logistical management cell focused on radiological consequence management

REAC/TS
Radiation Emergency Assistance Center/Training Site
Expert medical assistance for radiation exposure accidents

9

National Atmospheric Release Advisory Center (NARAC)

NARAC → Capabilities

Provides real-time predictions of atmospheric transport of radioactivity from a nuclear accident or incident

Plume model predictions

- Airborne or Ground Contamination
- Dose
- Protective Action Guidelines

Access to world-wide weather data and geographical information

- Observed & forecast weather data
- Terrain & land surface
- Maps
- Population

Real-time access to NARAC models

- Unclassified (Internet / Web) and classified communications
- Standalone simple plume models

24x7 scientific & technical support

National Atmospheric Release Advisory Center (NARAC)

Radiological Assistance Program

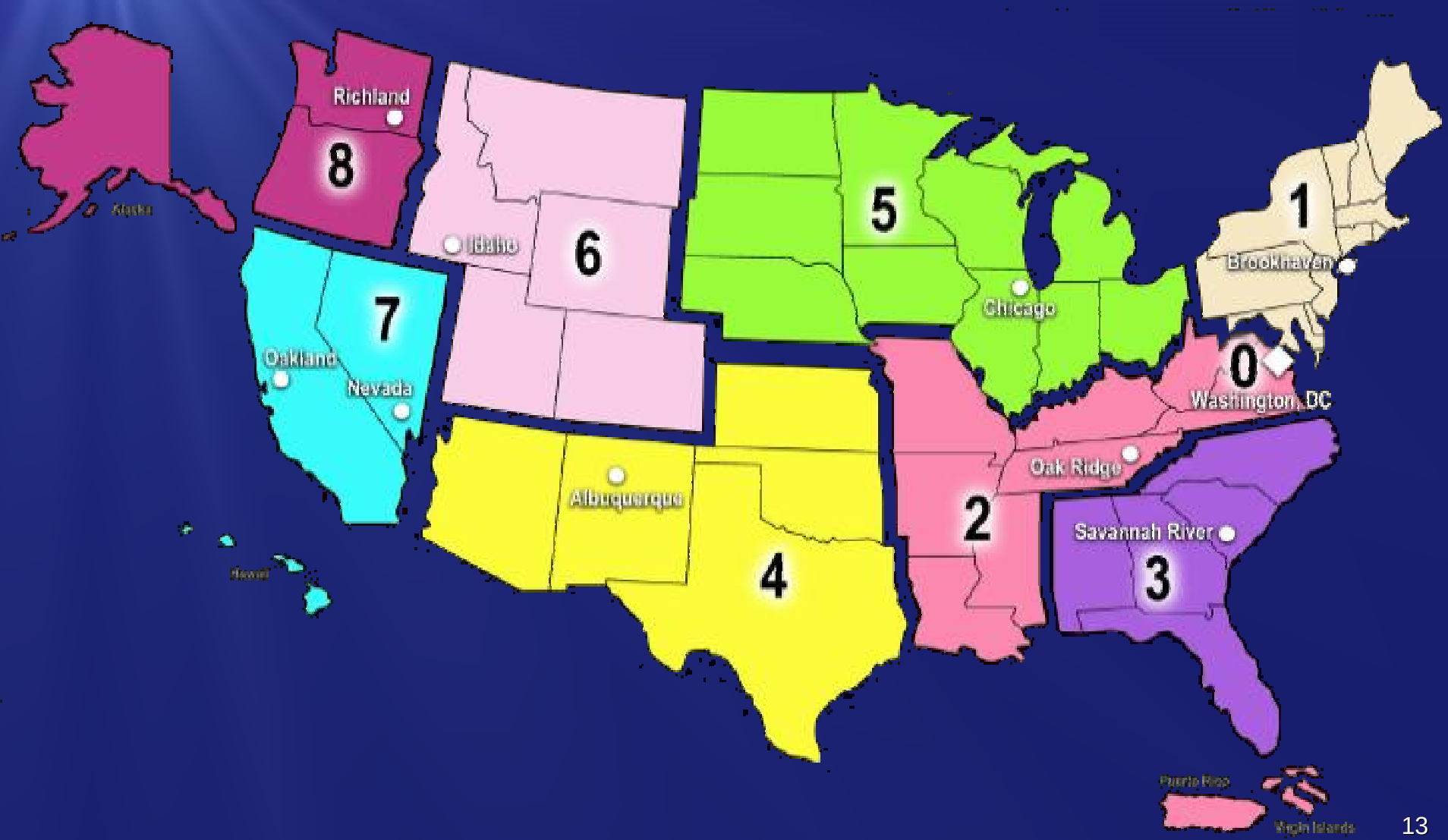
RAP

Capabilities

- **Search for Radiological Material**
- **First Responders**
  - **8 member team**
- **Advise on Public Safety**
- **Respond within 4-6 hours**
- **Characterize Radiation Environment**
  - **Initial Assessment**
  - **Area Monitoring**
  - **Contamination Control**
  - **Decontamination**
- **Material Recovery**
- **RAP may call upon other DOE assets**

Provides first response capability to Federal, State, local governments for incidents involving radiological emergencies

Radiological Assistance Program



Aerial Measuring System

AMS → **Capabilities**

Provides aviation-based equipment to survey large areas in response to radiological emergencies

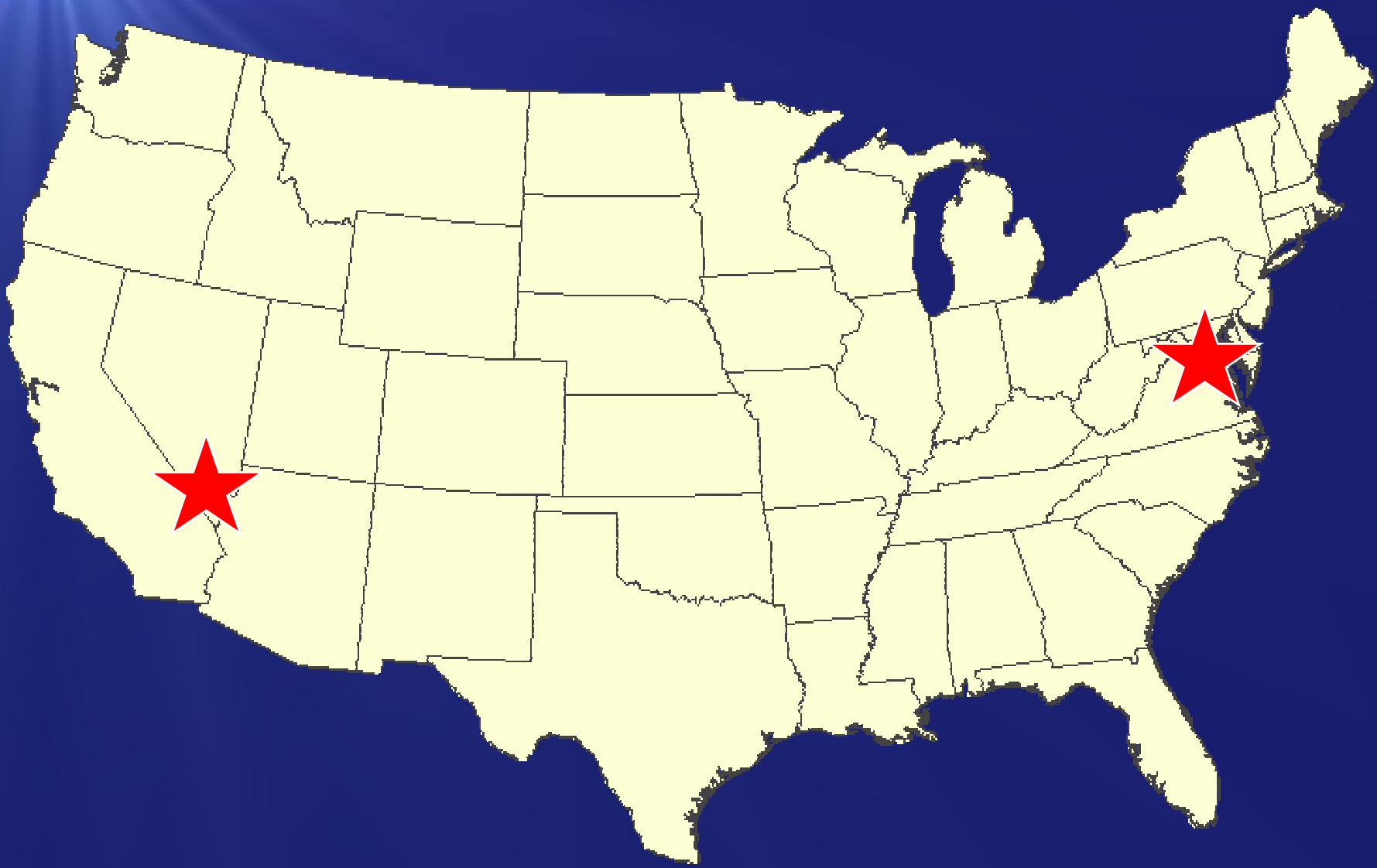
Fixed-Wing Aircraft

- All-weather operation
- Rapid residual fallout pattern
- Cursory radiological data transmitted during flight
  - Peak exposure rates

Helicopter

- Visual flight operation
- Detailed aerial surveys
  - Exposure rate contour maps
  - Dominant isotope gamma spectra
- Data analysis available 1-3 hours after flight completion

Aerial Measuring System



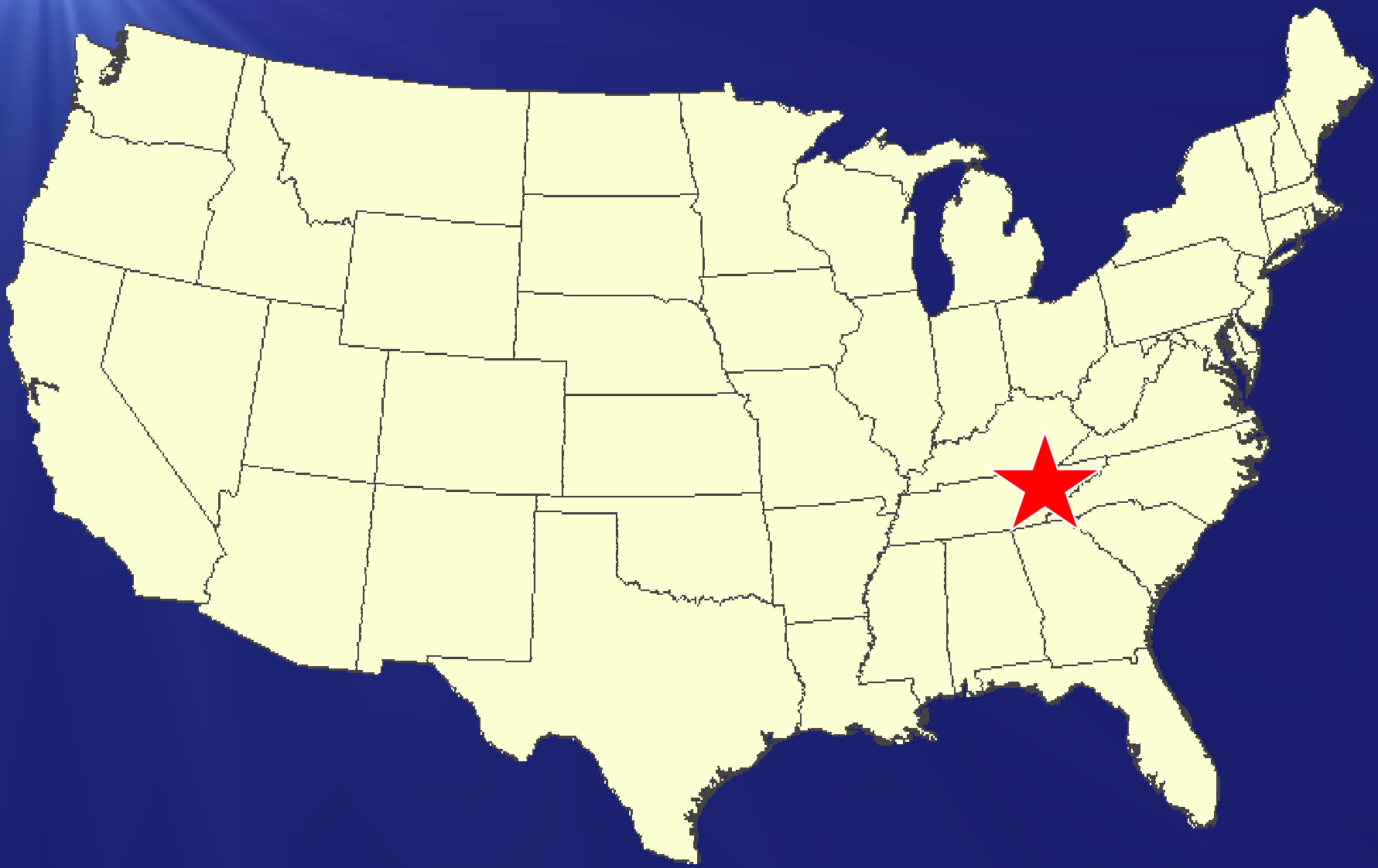
Radiation Emergency Assistance Center/Training Site (REAC/TS)

REAC/TS → **Capabilities**

Provides 24-hour consultation on radiation-affected health problems

- **Assistance to Federal, State, Local Governments as well as IAEA, Foreign Governments and Private Physicians**
- **Training Programs for Health Professionals**
- **Maintains "Radiation Accident Registry System"**
- **3-Person Team**
  - **Physician**
  - **Health Physicist**
  - **Nurse Paramedic**

Radiation Emergency Assistance Center/Training Site (REAC/TS)



Federal Radiological Monitoring And Assessment Center

FRMAC

Capabilities

Provides multi-agency operational framework for coordinating on-scene monitoring and assessments during a radiological emergency

CMRT Phase I

- Validate Protective Action Guidelines
- Gross Field Monitoring & Data Assessment
- Coordination with other Assets
- 31-Person Team

CMRT Phase II

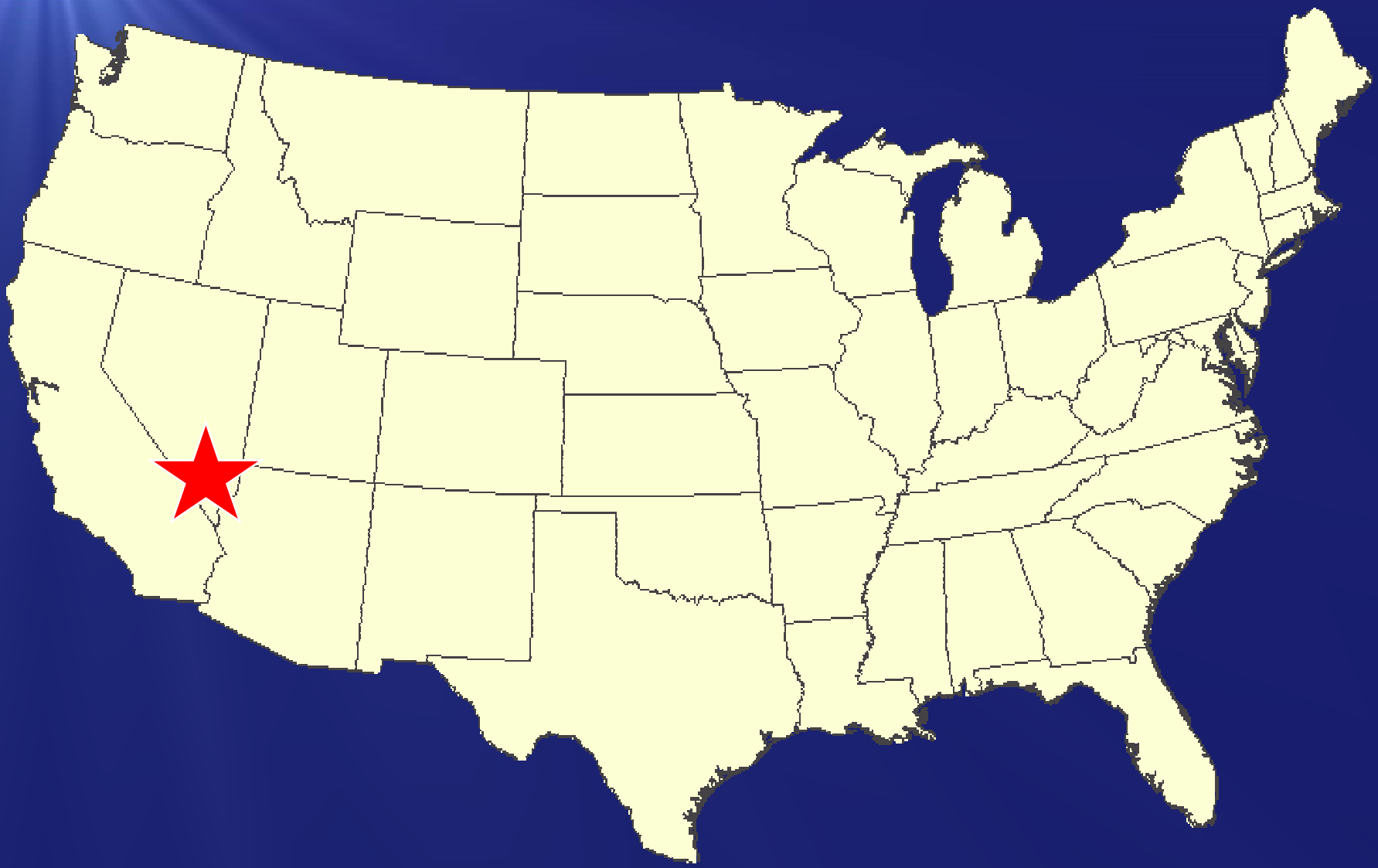
- Define where Population Relocation is warranted
- Extensive Field Monitoring & Sampling
- 32-Person Team

CMRT Phase III

- Ingestion Pathway Analysis
- Detailed Sampling & Analysis

CMHT

Federal Radiological Monitoring And Assessment Center



Purpose of FRMAC

Assist the states in their mission to **Protect the Health and Well-Being of their Citizens** by:

- Verified radiation measurements
- Interpretations of radiation distributions based on EPA, FDA or local Protective Action Guidelines
- Characterizations of overall radiological conditions

DOE Phased-Response Concept

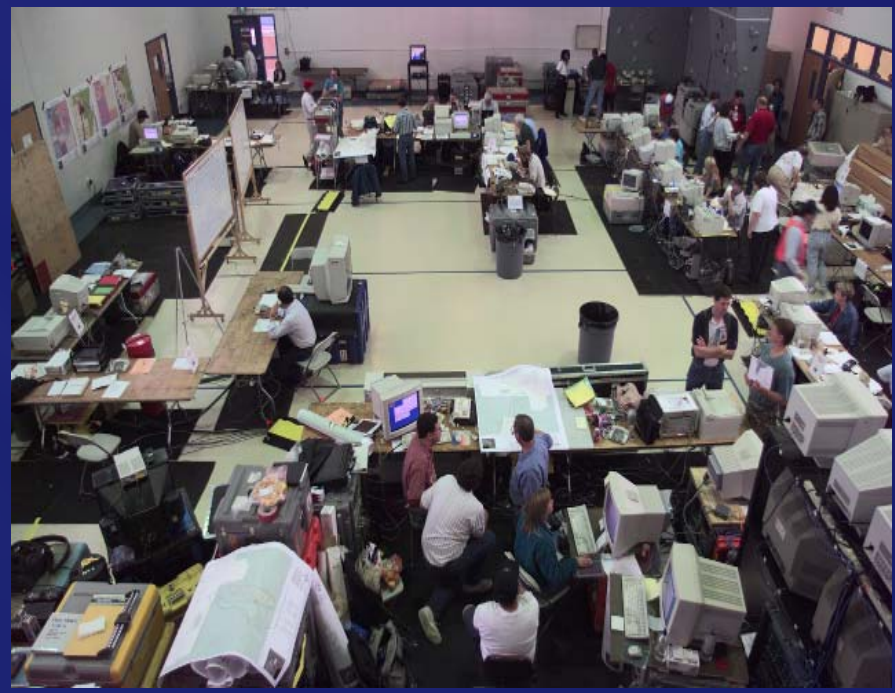
- Regional Response (RAP)
- Early CM Phase I, Phase II, and Phase III response by DOE personnel

Then…

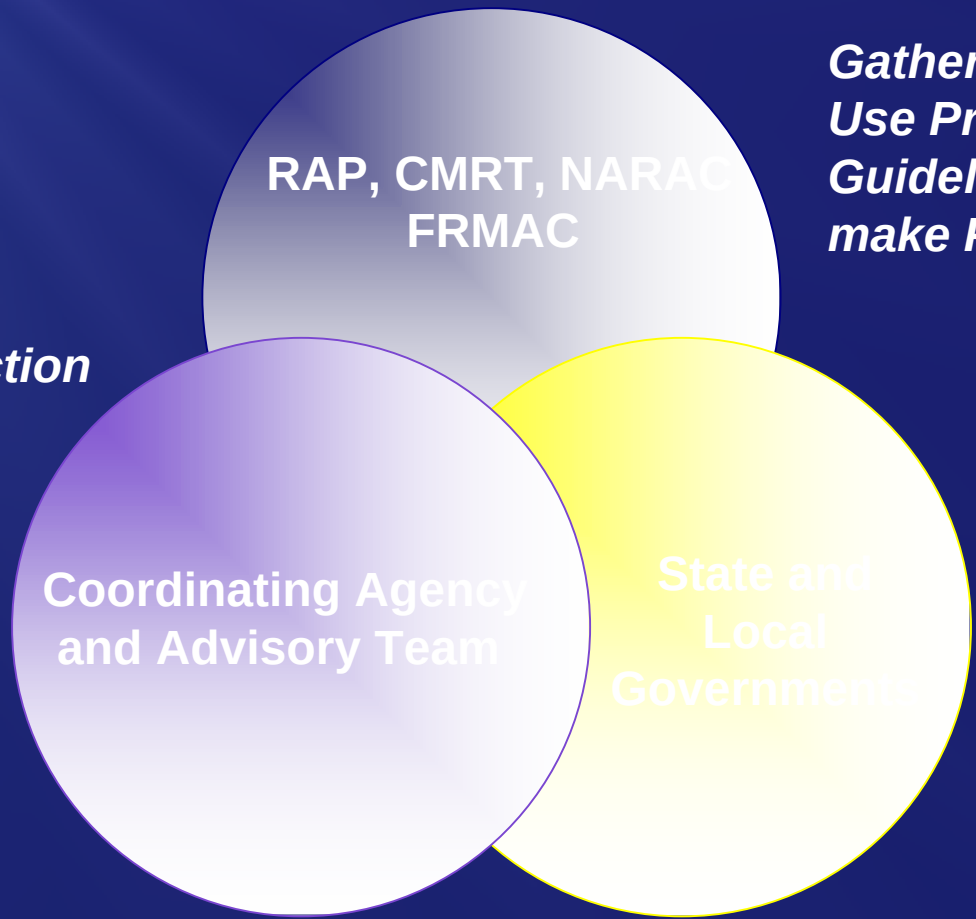
- Federal, state, and local agency activities are integrated and coordinated to form the FRMAC multi-agency response.

FRMAC

- Multi-agency response
- Monitoring and Sampling
- Responder Health and Safety
- Data Assessment
- Database and Documentation
- GIS
- Logistics support for Large scale/long-term operations



Coordinated Radiological Emergency Response



Gather facts.
Use Protective Action Guidelines and facts to make Projections.

Make Protective Action Recommendations

Shelter-in-Place
Evacuate
Return
Recovery

FRMAC Response Scenarios

- Nuclear Reactor accidents
- Accidents involving nuclear weapons
- Space vehicle re-entry (RTG)
- Radiation Dispersal Devices
- Others

Recent CM/FRMAC Exercises and Real-World Responses

Synergy, March 2004

Topoff II, May 2003

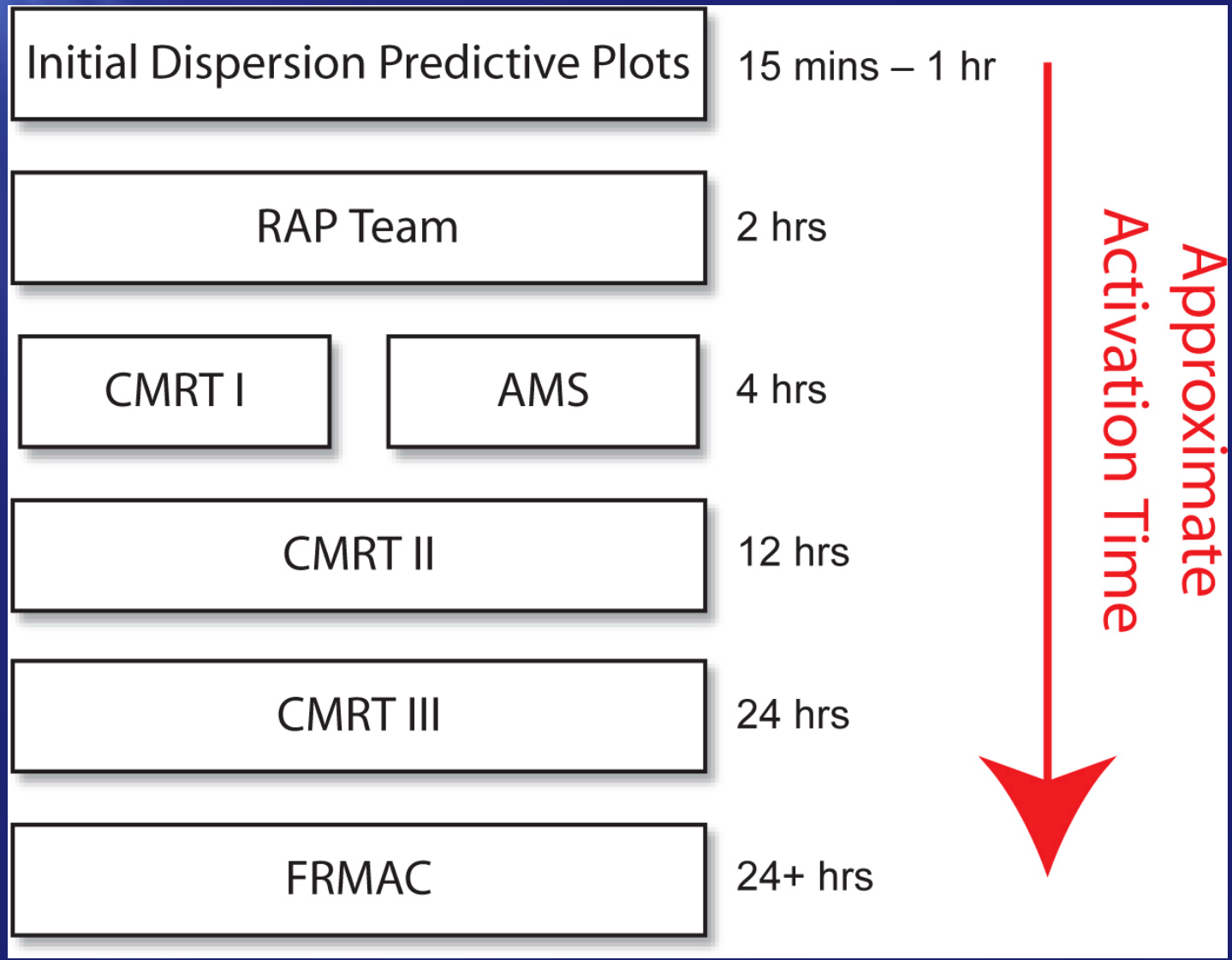
Southern Crossing
August, 2006

Cerro Grande Fire,
Los Alamos, May 2000

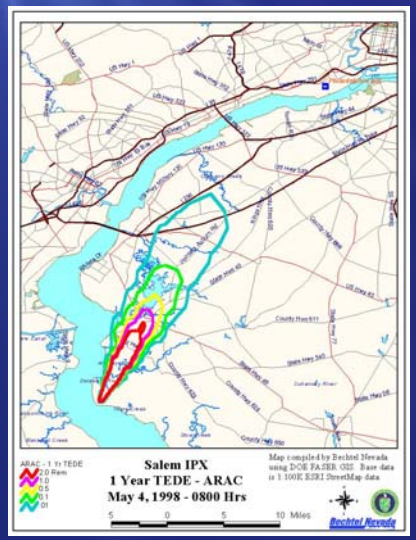
Exercise: Southern Crossing

- Full-scale, free-play field exercise conducted August 14-18, 2006
- RDD detonation in Dothan, AL
  - Contamination spread to Florida and Georgia
- 468 personnel involved from 3 States and 10 Federal departments/agencies
- First FRMAC full-scale exercise since the development of the National Response Plan and the National Incident Management System

Response Activation Table



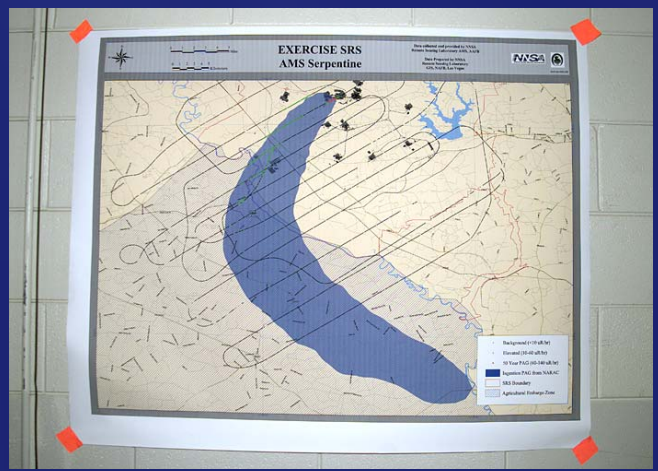
First Response



NARAC Predictive Plume Modeling

CM Home Team

AMS Fixed-wing Serpentine Overlay



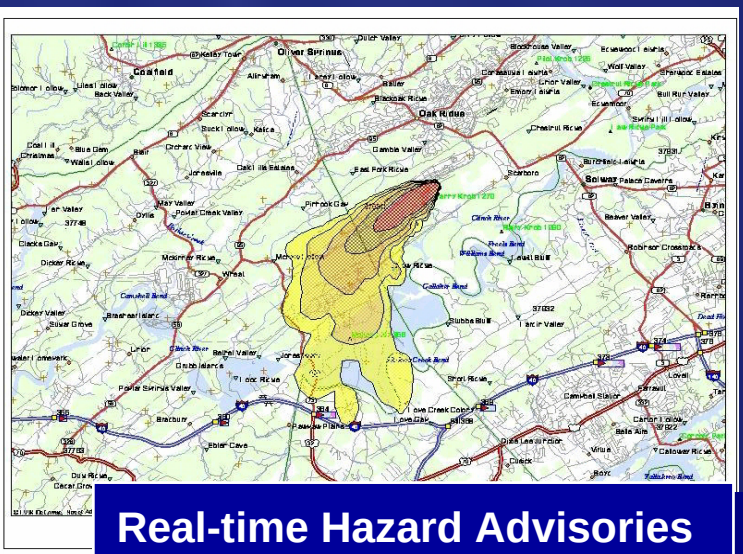
Regional DOE Response Assets

Predictive Plume Modeling

World-wide Coverage

- Terrain & land-surface
- Vector & raster maps
- Real-time weather data

National Center at LLNL NARAC staff operates the center, trains users and deploys for special events



Real-time Hazard Advisories

- Available within minutes
- Distributed electronically

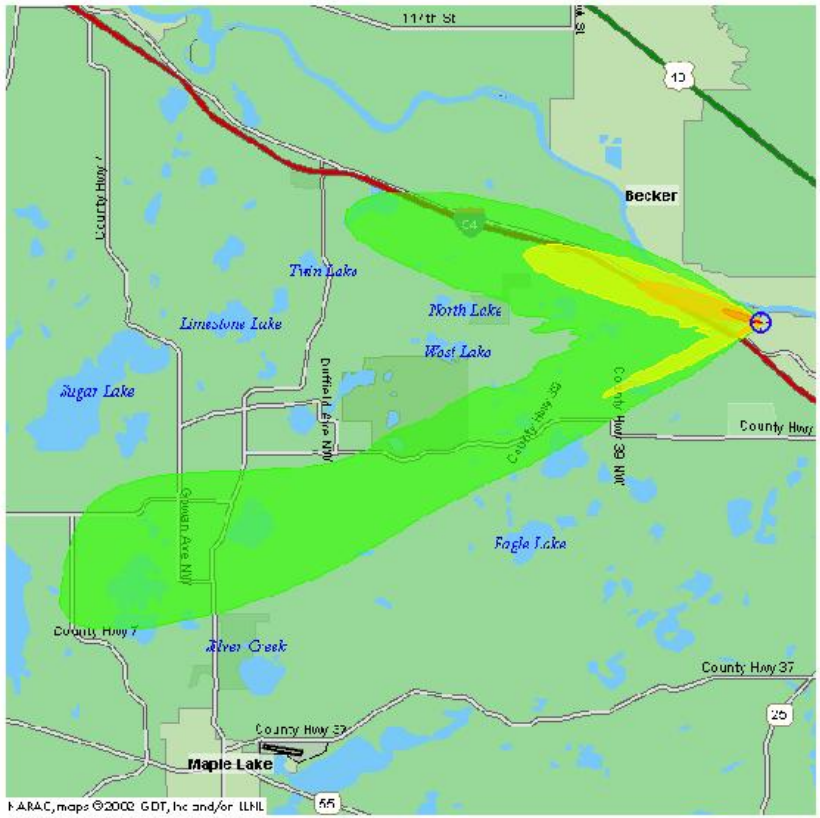
Nuclear, Chemical, Biological & Natural Releases

- Generic and specific sources
- Advanced modeling system
- Health effects and action levels

Initial NARAC Plot

Planning Set 3: 4-Day TEDE

Planning Set 3: TEDE, Thyroid Dose, Gnd Exp Dose Rate
rcC7712 - unknown



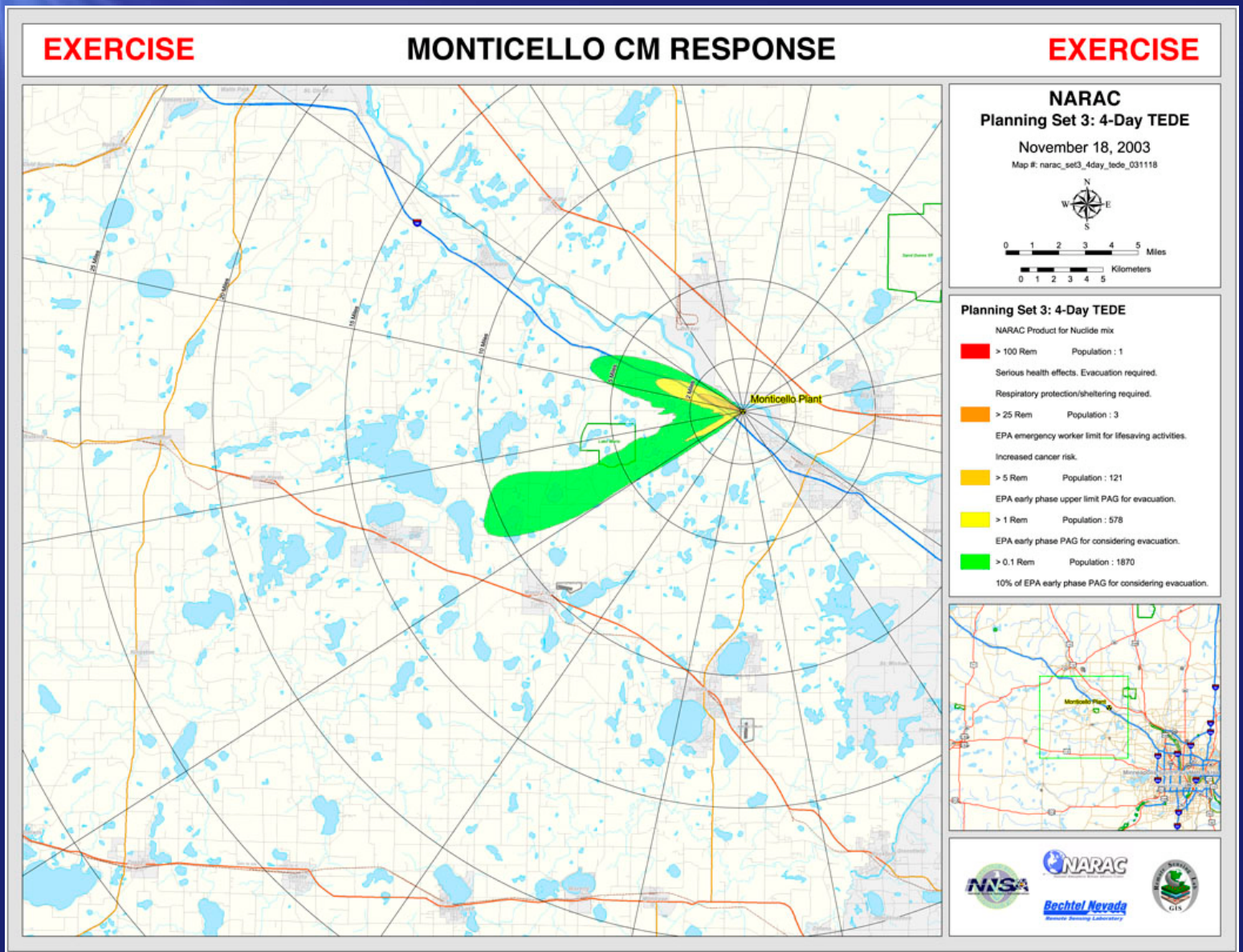
Effects or contamination from 18 Nov 2003 14:30 UTC to 22 Nov 2003 14:3

Consequences and Actions			
	(Rem) Area Extent	**Population**	**Description**
	>100 0.008 km2 n/a	1 n/a	Serious health effects. Evac. req. Respiratory protection/sheltering req.
	>25 0.1 km2 n/a	3 n/a	EPA emerg. worker limit for lifesaving activities. Increased cancer risk.
	>5.0 1.1 km2 n/a	121 n/a	EPA early phase upper limit PAG for evacuation.
	>1.0 6.1 km2 n/a	578 n/a	EPA early phase PAG for considering evacuation.
	>0.1 57.2 km2 n/a	1,870 n/a	10% of EPA early phase PAG for considering evacuation.
Note: Areas and counts in the table are cumulative.			

Source Location: 45.333333 N, 93.848333 W
Material: Nuclide mix
Comments: Time-varying release rates.
Time-varying canned metdata
including rain.
Not For Public Dissemination

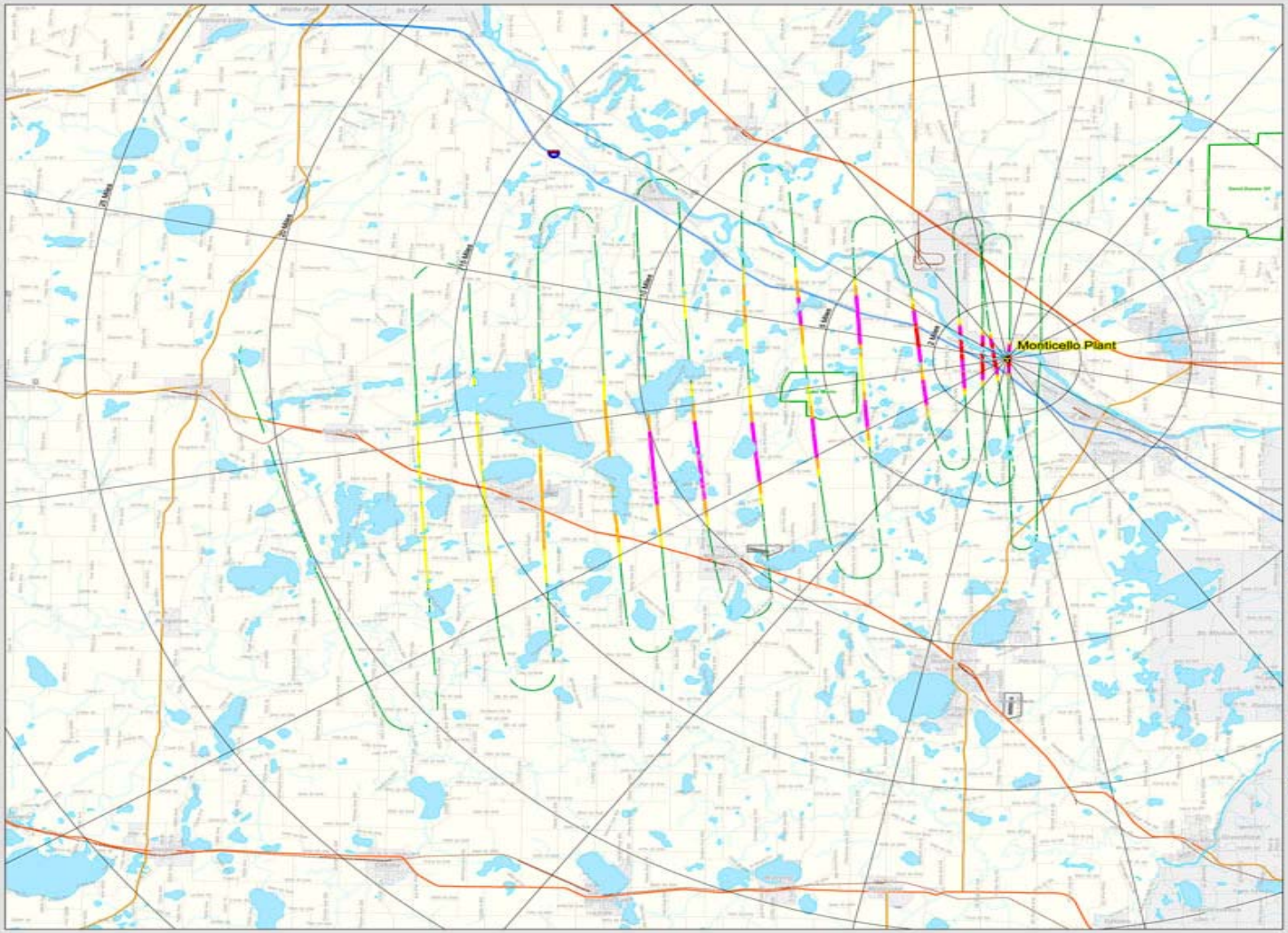
Map Size: 20.55 km by 20.55 km **Id:** Production.rcE7738.rcC7712
NARAC Operations: narac@llnl.gov; (925) 424-6465
Requested by: (, ; unknown)
Not approved for further distribution

NARAC Prediction 4-Day Total Effect Dose Equivalent



AMS Fixed Wing Survey for Ground Exposure Rate

EXERCISE — MONTICELLO CM RESPONSE — EXERCISE



AMS Fixed-Wing Aircraft
External Exposure Rate
November 18, 2003 1015 - 1150 CST
Map #: ams_B200_031118

N
W E
S

0 1 2 3 4 5 Miles

Kilometers
0 1 2 3 4 5

AMS B200 Serpentine
External Exposure Rate

- < 50 uR/h
- 50 - 200 uR/h
- 200 - 1,000 uR/h
- 1,000 - 10,000 uR/h
- 10,000 -100,000 uR/h
- >100,000 uR/h

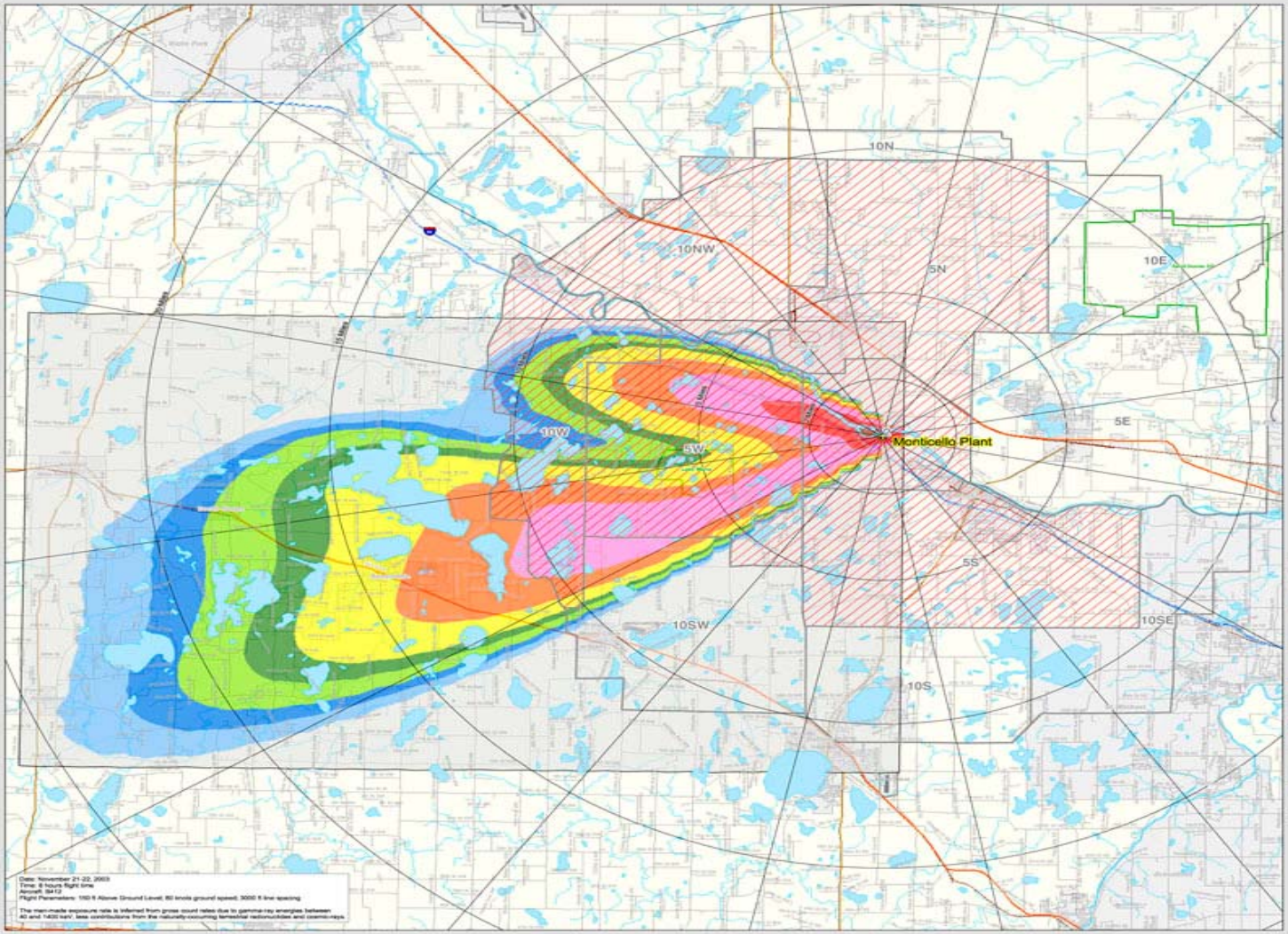
NNSA NARAC Bechtel Nevada

AMS Helicopter Survey for Isotopic Deposition

EXERCISE

MONTICELLO CM RESPONSE

EXERCISE



AMS Helicopter External Exposure Rate
November 21-22, 2003
Map #: 2_ams_helicopter_simulation_031121-22

N
W E
S

0 1 2 3 4 5 Miles
0 1 2 3 4 5 Kilometers

AMS Helicopter Survey
Man-Made Exposure Rate (μR/hr)

- < 2
- 2 - 5
- 5 - 10
- 10 - 25
- 25 - 50
- 50 - 200
- 200 - 1,000
- 1,000 - 10,000
- 10,000 - 100,000
- > 100,000
- Sub-Area
- Evacuated Sub-Area

NNSA NARAC Bechtel Nevada

Monitoring

Objectives:

- Protect lives and property
- Define plume footprint
- Monitor key infrastructure
- Provide support for population monitoring and decontamination

Data:

- Direct monitoring measurements
- Isotopic mix (*in situ* spectroscopy)
- Sampling
- Quality Assurance / Quality Control

Field Monitoring Activities and Equipment

Sampling Activities

Air Sampling

Food Sampling (Honey)

Water Sampling

Vegetation Sampling

Soil Sampling

Sample Hotline Area

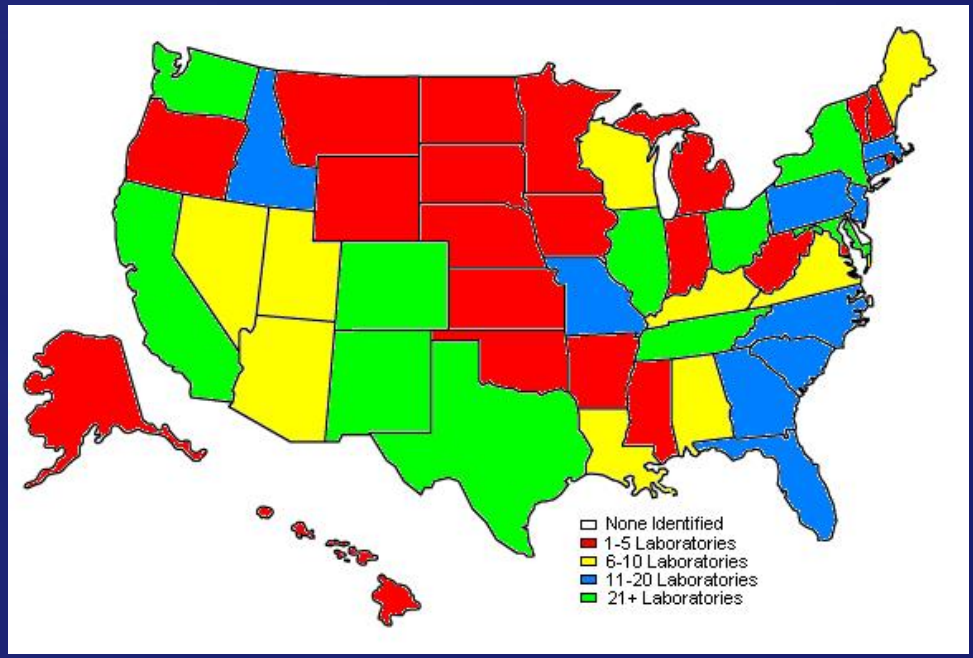
- Directional signs and areas marked.
- Periodic contamination surveys conducted.
- Monitoring to ensure doses are ALARA.
- Area as “habitable” as possible (chairs, cooling/heating, etc.).
- Co-located near personnel and equipment hotline (away from FRMAC and labs).

Sample Preparation

- Documentation
  - database entry
  - chain-of-custody (sample tracking)
  - laboratory database
  - QA/QC process
- Creating aliquots (split samples if required)
- Packaging and transport to laboratory

Sample Analysis

- Laboratory Information Management System
- Quality Assurance & Quality Control process
- Laboratory Database
- Multi-Modal Laboratories



Assessment

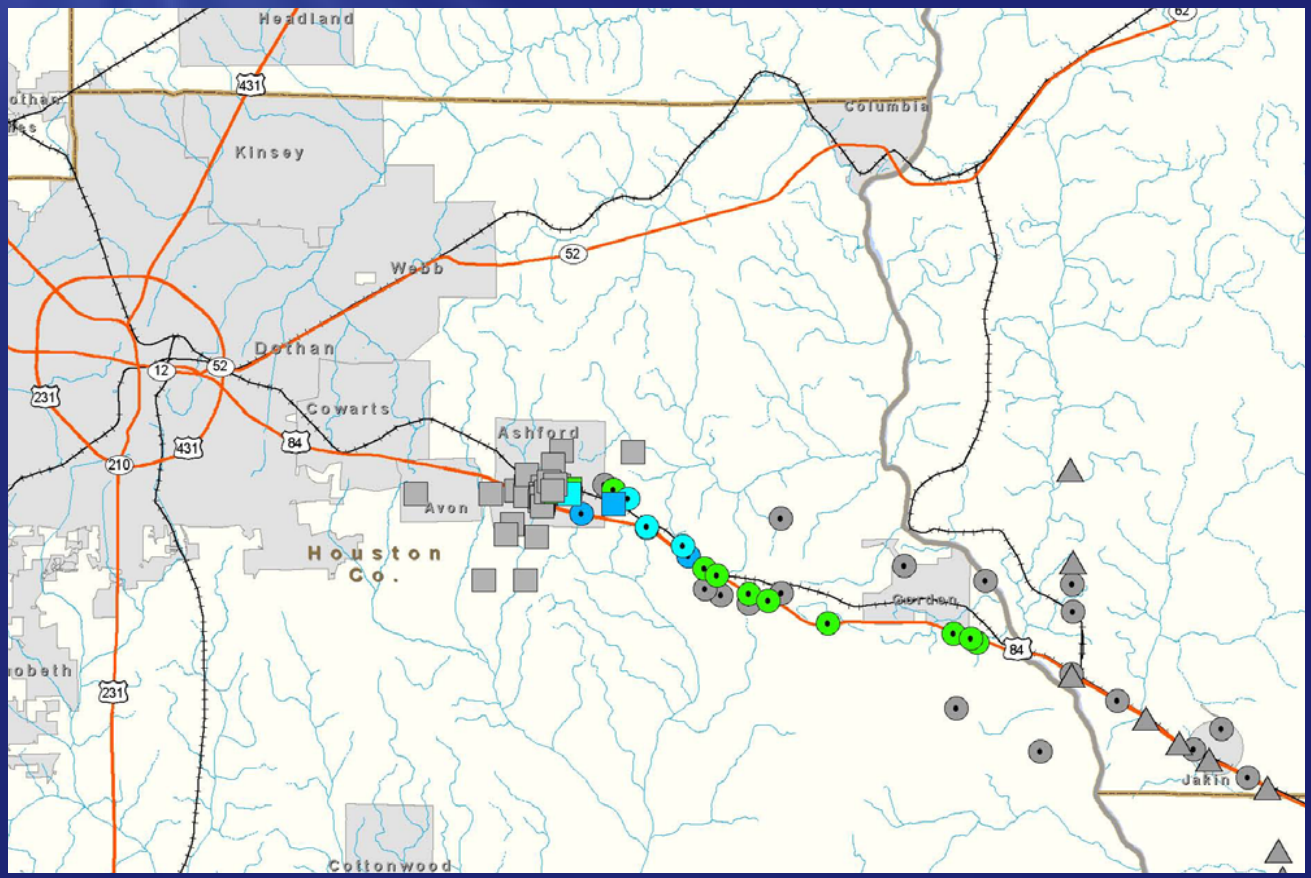
Assessment Does:

- Provide interpretations of radiological conditions in terms of recognized Federal or State Protective Action Guidelines (PAGs)
- Characterizes radiological environment to address re-entry, return and recovery issues

Assessment Does Not:

- Offer or develop Protective Action Recommendations (PARs)
- Make Protective Actions Decisions

Monitoring Maps



Field Monitoring Locations

FRMAC, EPA and State of Georgia Data Points

Map Date: 8/15/2006 11:06:38 PM
Map ID: 060815 1130 Field Measurement Locations.mxd

1:200,000

0 2.5 5 7.5 10 Miles

0 2.5 5 7.5 10 Kilometers

FRMAC Field Monitoring

Exposure Rate (µR/hr)

- 1st Year Relocation PAG (> 330µR/hr)
- 2nd Year EPA Relocation PAG (> 84µR/hr)
- 50 Year EPA Relocation Level (> 28µR/hr)
- (< 28 µR/hr)

EPA Field Monitoring

Exposure Rate (µR/hr)

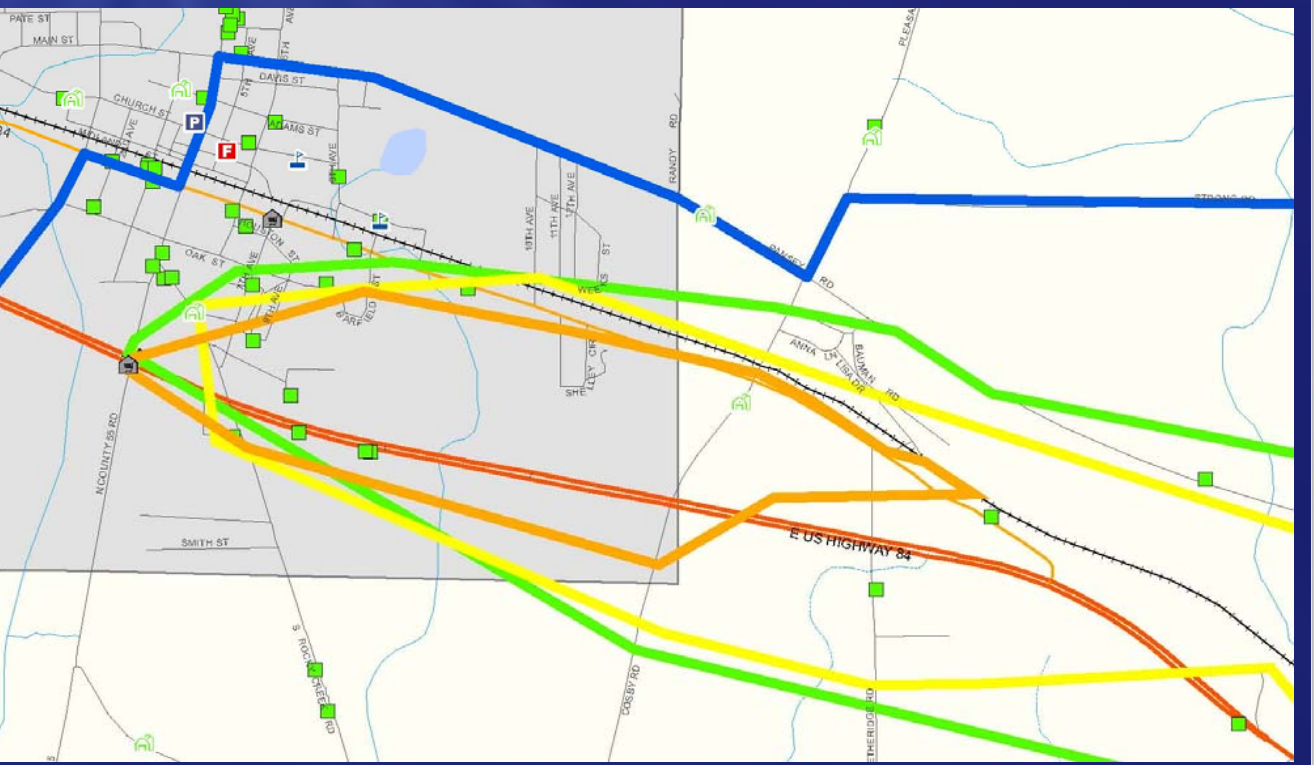
- 1st Year Relocation PAG (> 330µR/hr)
- 2nd Year EPA Relocation PAG (> 84µR/hr)
- 50 Year EPA Relocation Level (> 28µR/hr)
- (< 28 µR/hr)

State of Georgia Field Monitoring

Exposure Rate (µR/hr)

- 1st Year Relocation PAG (> 330µR/hr)
- 2nd Year EPA Relocation PAG (> 84µR/hr)
- 50 Year EPA Relocation Level (> 28µR/hr)
- (< 28 µR/hr)

Exclusion Zones



PAG + Exclusion Zone and Business Data Points

Vicinity of Dothan, AL

Map Date: 8/17/2006 3:43:57 AM
Map ID: 060816 1930 PAG + EvacZone + PopData.mxd

N

0 0.25 0.5 0.75 1 Miles

0 0.25 0.5 0.75 1 Kilometers

- 1st Year Relocation (Population: 145)
- 2nd Year Relocation (Population: 288)
- 50 Year Relocation (Population: 611)
- Evacuation Zone (Population: 1,629)
- Farms & Ranches
- Feedlots
- FireStations
- LocalPolice
- Schools
- GroceryStores
- Bakeries
- Claritas Business Location

Transfer of FRMAC Management from DOE to EPA

- Immediate emergency condition is stabilized.
- Off-site release of radioactive material has ceased.
- Off-site radiological conditions have been characterized.
- Initial or long-range monitoring plan has been developed.
- Other Federal agencies will commit required resources.

Current Initiatives

- Automated Data Transfer and Assessment – “Paperless FRMAC”
- Equipment Improvements
  - Data Acquisition Systems
  - In Situ Actinide Measurements
- Incident Command System / National Incident Management System Compliance
- Laboratory Analysis – Integration with fixed and mobile laboratories
- Outreach with State / Local capabilities

Conclusion: Functionality

- First Response (RAP)
  - Radiological Monitoring
  - Transportation Accidents – Small Scale
- Atmospheric Plume Monitoring (NARAC)
- Aerial Radiological Measurements (AMS)
- Medical Effects of Radiation (REAC/TS)
- Consequence Management Operations (CMRT/FRMAC)

CM/FRMAC Program Managers

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