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United States of America's Consequence Management (CM) Program Overview

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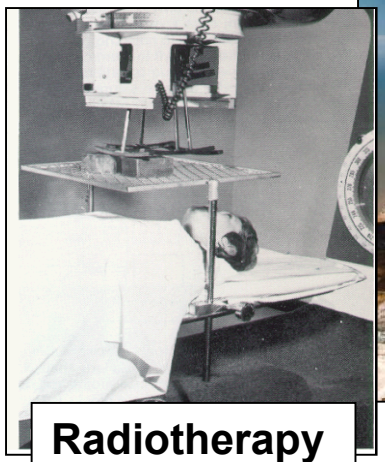
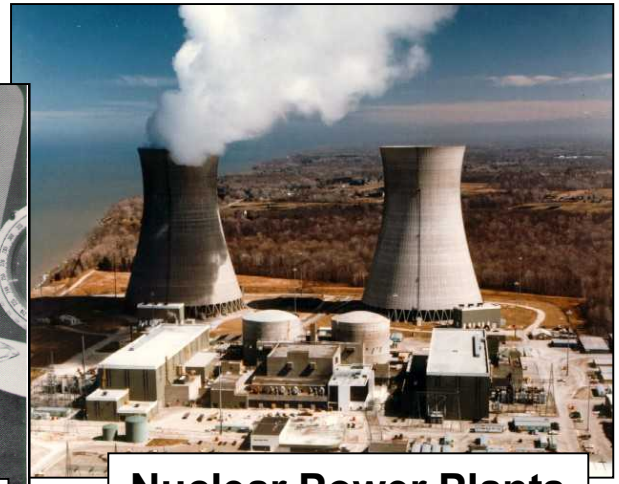
Large Quantities of Radioactive Material can be Found Throughout the World

- Nuclear Power Reactors
- Nuclear Explosives
- Medical/Industrial Applications
  - Therapy Equipment
  - Sterilization Equipment
  - Density Gauges
  - Well Logging
  - Radiography
  - Thickness and Level Gauges
  - Power Generation
  - Radioisotopic Thermal Generators (RTG)

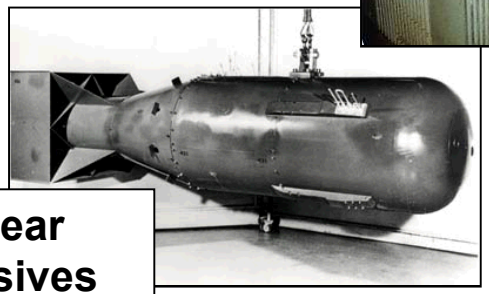


Radiotherapy Unit



Nuclear Power Plants

RTG

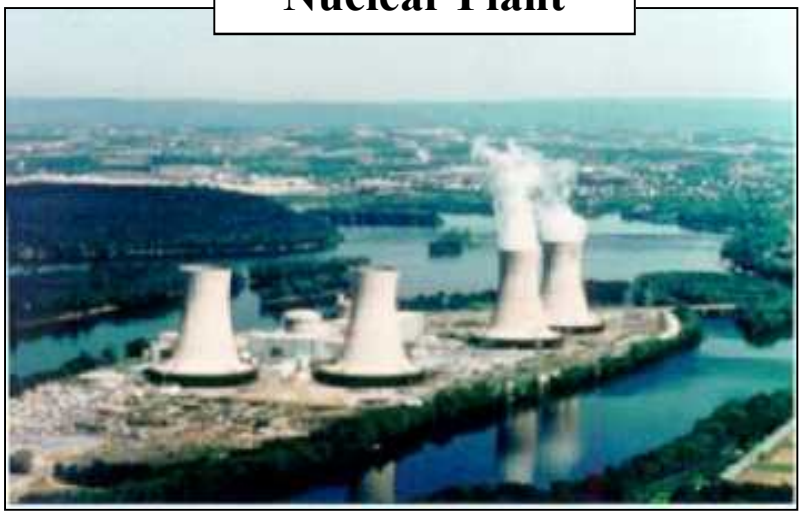


Nuclear Explosives

Consequence Management Program History

- **March 28, 1979: Three Mile Island Plant**
  - **Plant experiences a reactor coolant failure.**
  - **Decision errors made the situation worse.**
  - **Partial meltdown of the reactor core.**
  - **Ultimately resulting in a controlled venting of radioactive material from the reactor.**

Three Mile Island Nuclear Plant



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Consequence Management Program History

- **Three Mile Island event highlighted inadequacies in planning for a large Nuclear Emergencies.**
  - **Evacuation Plans for the nearby cities were completely inadequate.**
  - **Significant confusion about actions.**
- **Government legislated federal preparations for Radiological Emergencies.**
- **This lead to development of the current program.**
  - **Initial efforts focused on Nuclear Power Reactor or Weapon Accidents.**

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New CM Focus

- The events of September 11, 2001 resulted in a philosophical change:
  - Terrorists may strike with no warning
  - First knowledge of nuclear terrorism attack may be the explosion/dispersion
- CM transitioned focus to preparations for intentional terrorist attacks (DNE, RDD)

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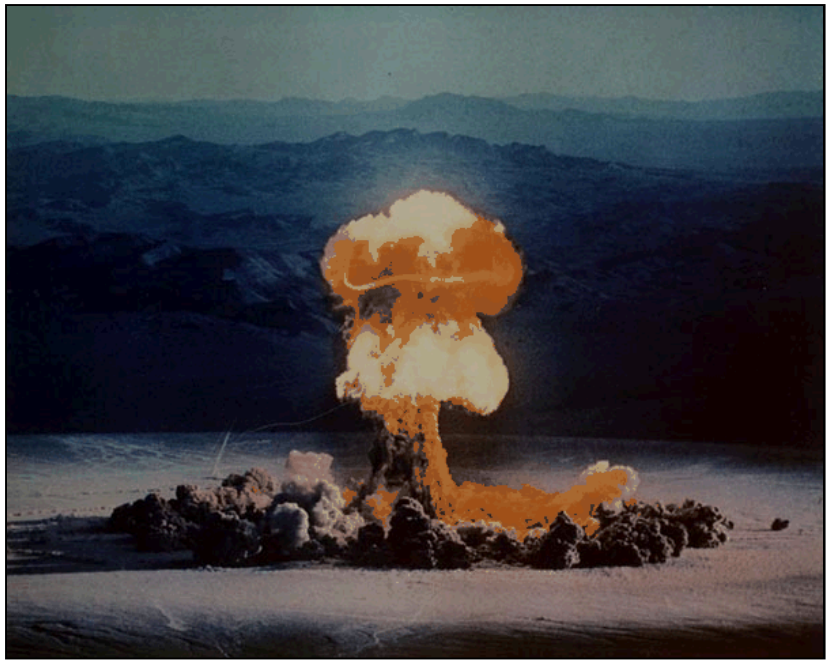
Domestic Nuclear Explosion (DNE) Impacts

- Terrorists and rogue nations are attempting to obtain Nuclear Materials and Explosives
- Simple Weapon Designs available on WEB

- Domestic Nuclear Detonation would have devastating consequences.
  - Hundreds of thousands to over a million people highly contaminated
  - Local official requiring technical assistance



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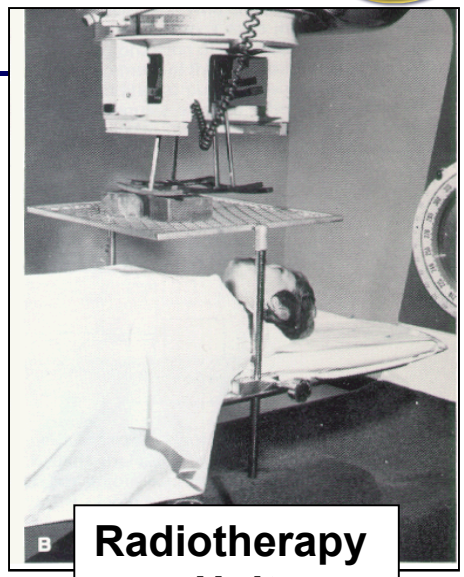
Radioactive Dispersal Device (RDD) Threat

- Radioactive sources that are widely used in the civilian and military sectors could be employed in “dirty bombs” or radiological dispersal devices (RDDs).



Radiotherapy Unit

- “The detailed instructions on how to make dirty bombs found in al Qaeda’s caves make horrifyingly clear our need to have a firm plan to reduce the vulnerability of the most dangerous of these materials to acquisition by those seeking to use them as weapons of terror.”

Energy Secretary Spencer Abraham to IAEA General Conference, Sept. 16, 2002

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What is an RDD?

RDDs can come in several forms:

- Explosive device containing radioactive materials (includes explosion, implosion, or other energetic methods of dispersion).
- Passive device or non-energetic devices, including sprayers and direct exposure devices.

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RDD Impacts

- Injuries would be from initial blast not from radiation
- Panic
- Increased risk of long-term cancers
- Massive cleanup costs

Consequence Management (CM) Program

Mission:

- Develop and maintain rapidly-deployable equipment and technical expertise for world-wide response to nuclear and radiological terrorism events as well as nuclear/radiological accidents or emergencies.

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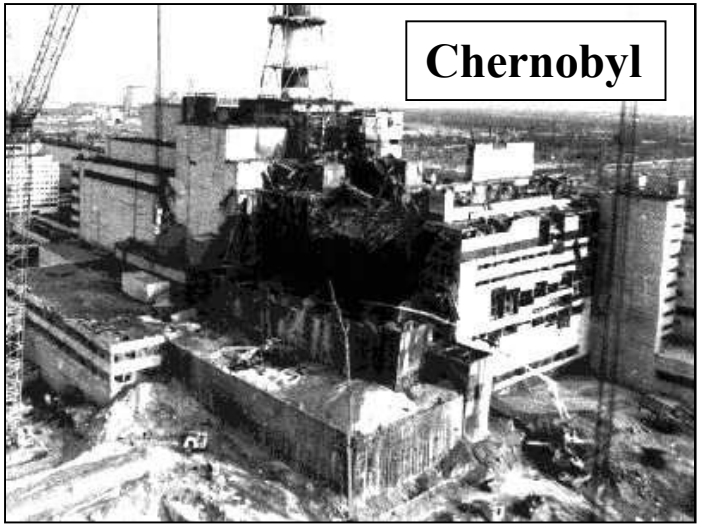
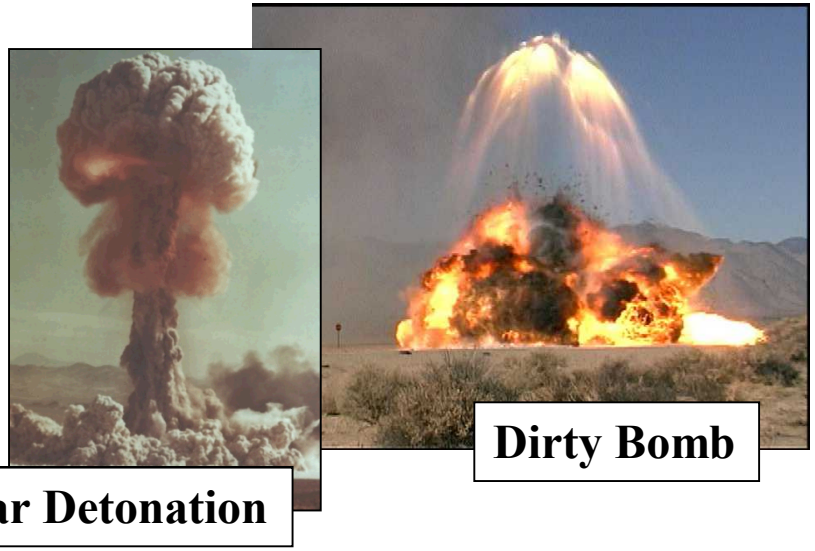
Consequence Management Response Areas

- **Accidental Events:**
  - Chernobyl
  - Goiania, Brazil
  - Three Mile Island
  - Nuclear Weapon Accident
- **Intentional Events:**
  - Terrorist Nuclear Explosive Device
  - Terrorist Act “Dirty Bomb”

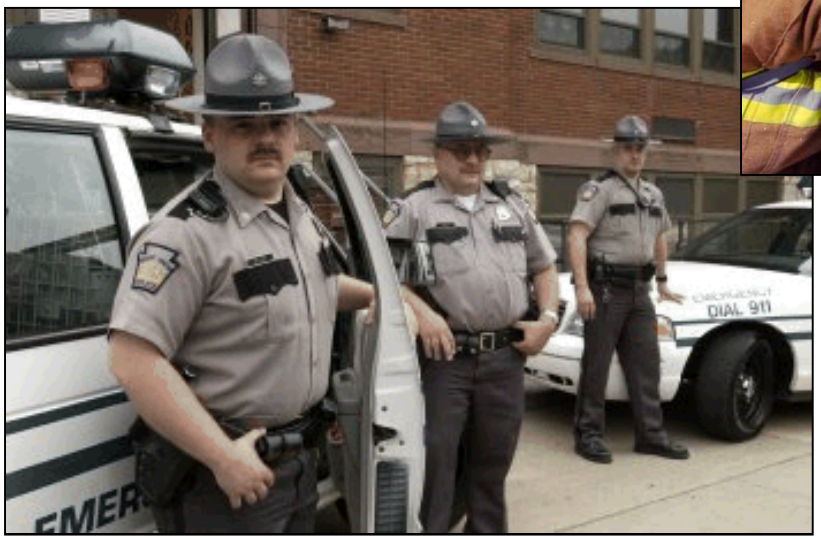




How Does the US Respond

Response Timeline
T = 0 to 1 Hour

- **Local Police and Fire Fighters first to arrive and determine a radiological event has occurred.**



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Response Timeline
T = 0 to 1 Hour

- **Local Authority and/or Nuclear Facility will implement its Emergency Response Plans**
- **State and Local Officials will be notified.**
  - **Local First Responders will be first to arrive on the scene.**
  - **First Responders will begin responding to the emergency and evacuation of local area based upon Emergency Response Plans.**

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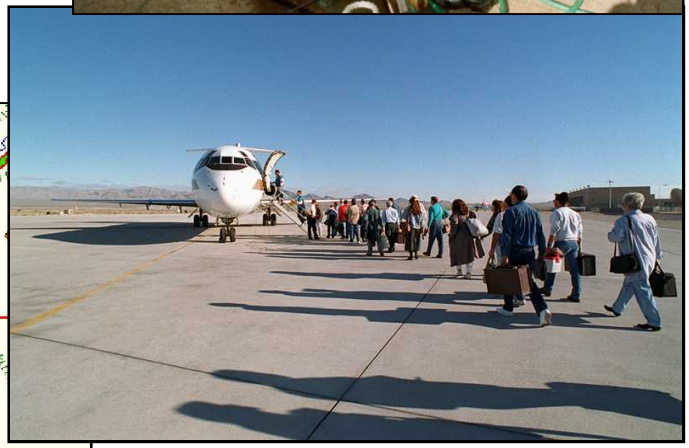
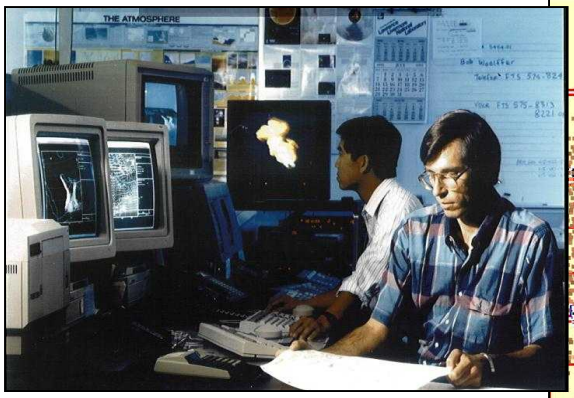
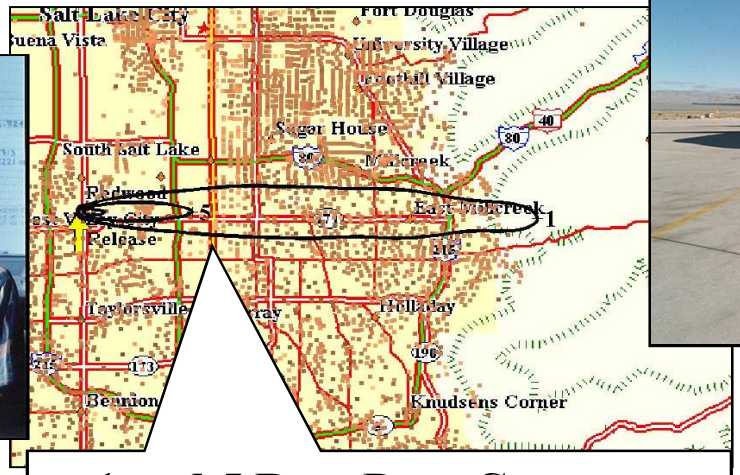
CM Resource Response
Timeline T = 1 to 6 Hours

- **NNSA's Radiological Assistance Program Teams (RAP Teams) begin to arrive.**
- **CM Response Teams Alerted.**
- **NNSA's Plume Dispersion Modeling underway.**







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Radiological Assistance Program Teams Arrive

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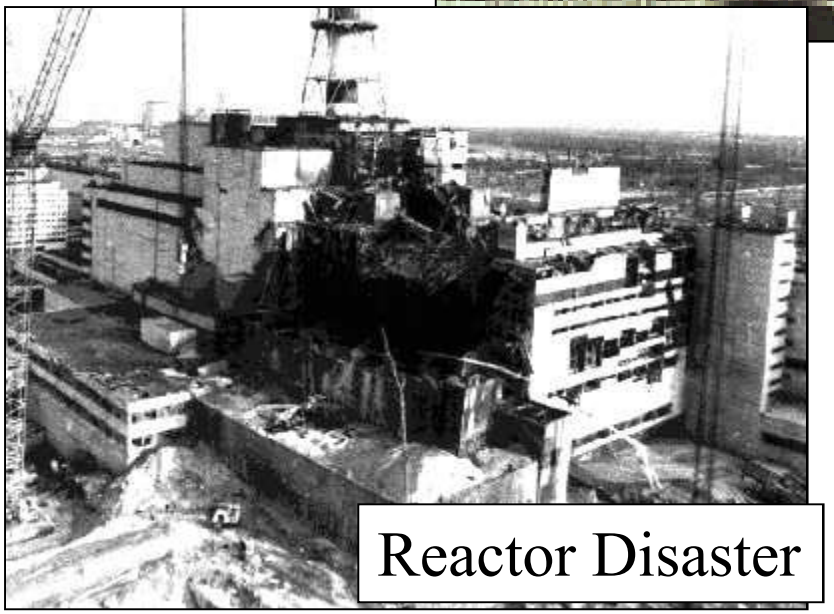
If A Large Radiological Event Has Occurred

- **Department Of Homeland Security activates National Consequence Management Assets.**
- **CM Assets in route within 4-hours.**



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CM Response
Timeline T = 24 to 36 Hours

- **CM Response Teams arrive (approximately 150 - 400 additional personnel in 3 teams).**

- **Provides experts to support the operations:**
  - **Sampling Experts**
  - **Lab Analysis Experts**
  - **Health and Safety Experts**
  - **Assessment Experts**
  - **Radiological Technicians**

- **All of these individuals take on specific roles as defined in pre-event planning/training.**

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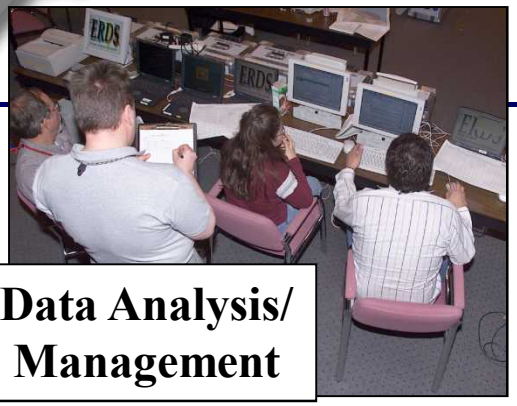
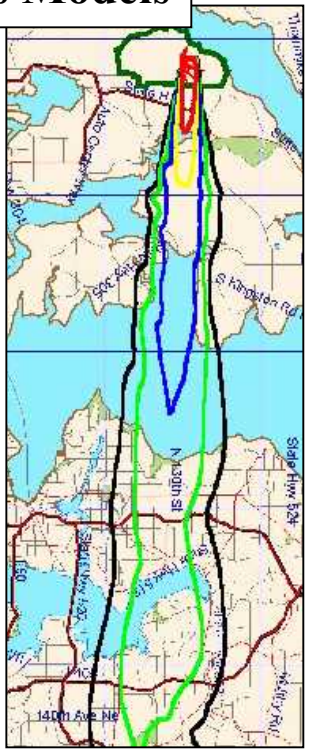
Consequence Management (CM) Assets



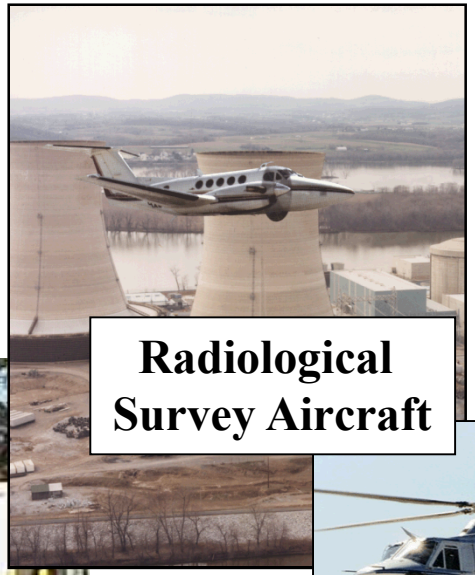
Data Analysis/ Management

Field Personnel

SNL & LLNL Effects Models



Laboratory Personnel

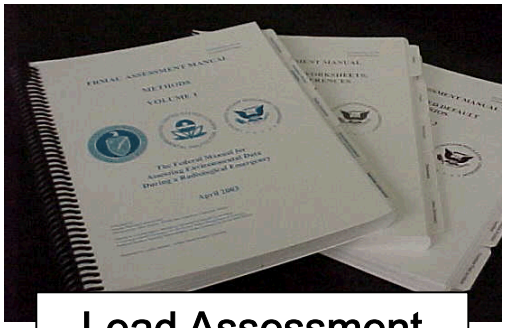


Radiological Survey Aircraft

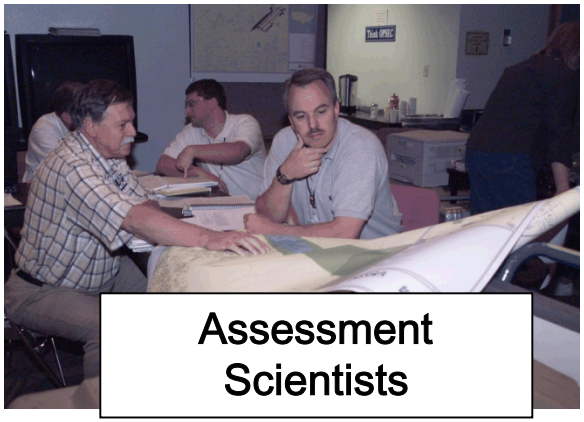
Mobile Laboratories

Sandia's Consequence Management Expertise

Experimental Facility used to Characterize WMD Source Terms

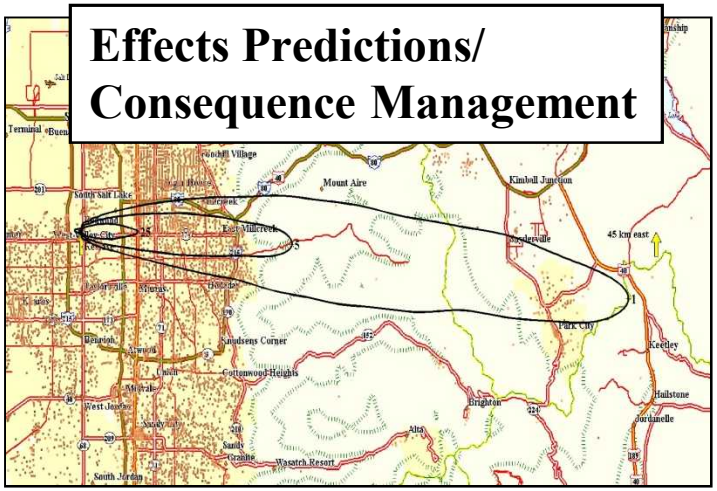


Lead Assessment Specialty



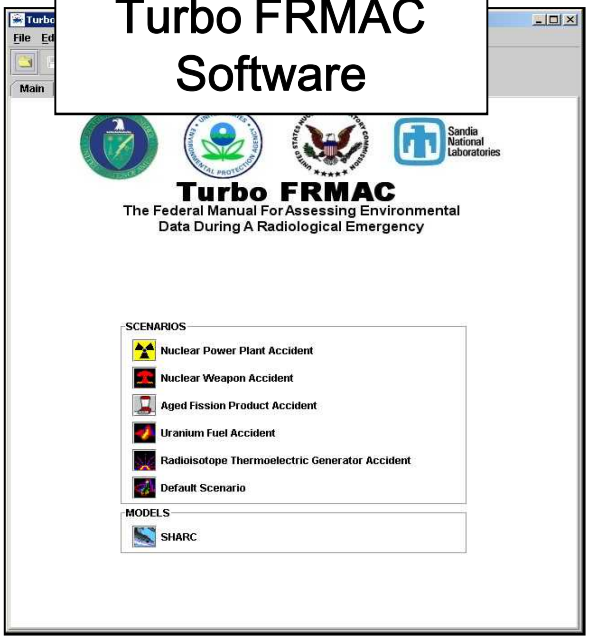
Assessment Scientists

Effects Predictions/ Consequence Management



SNL RAP Teams

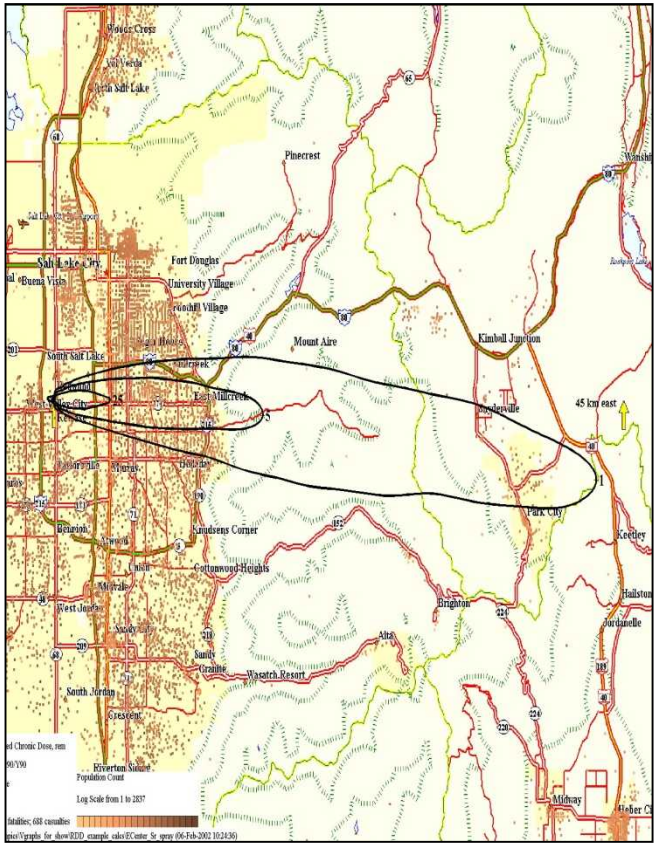
Turbo FRMAC Software



Effects and Consequence Prediction

- **Ability to predict the dispersal of radioactive material based upon real time weather conditions**
  - unmitigated and mitigated explosive releases of radioactive materials (non-yield nuclear explosions, and RDDs)
  - fallout from nuclear detonations
  - releases of Chemical and Biological agents

- **SNL provide rapid information for local authorities**.

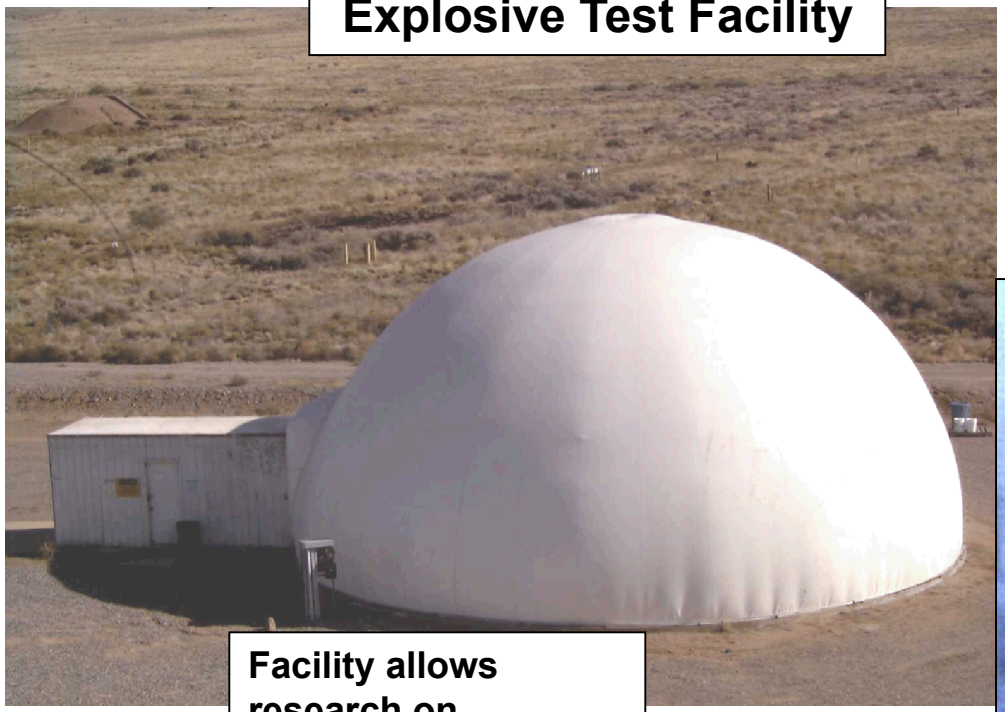


Consequence Reports

- Standardized report integrating effects predictions with GIS provides consequence information in a format more directly useful to decision makers
- Reports are customized for different WMD scenarios or accident situations
- Different levels of detail can be selected
  - summary, full report, full report including background and reference information

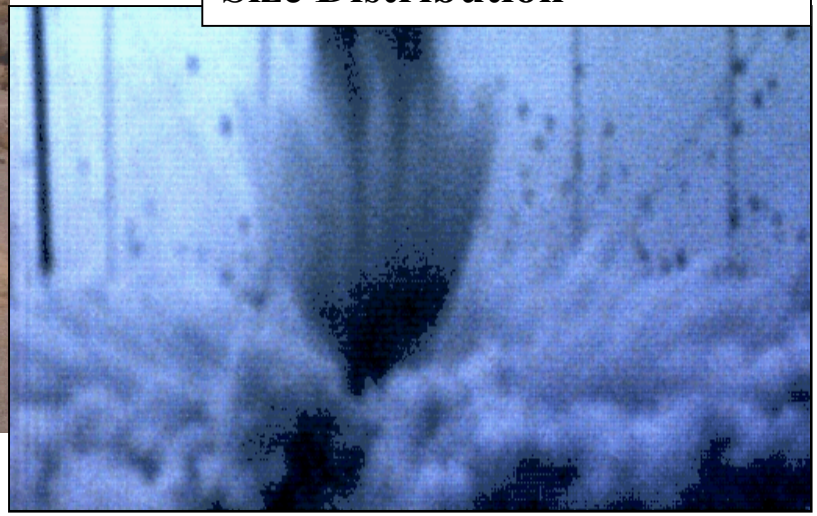
Particle Size Distribution Experiments

Explosive Test Facility



Facility allows research on explosive dispersion of radioactive materials.

Explosive Dispersal Testing to Determine RDD Particle Size Distribution



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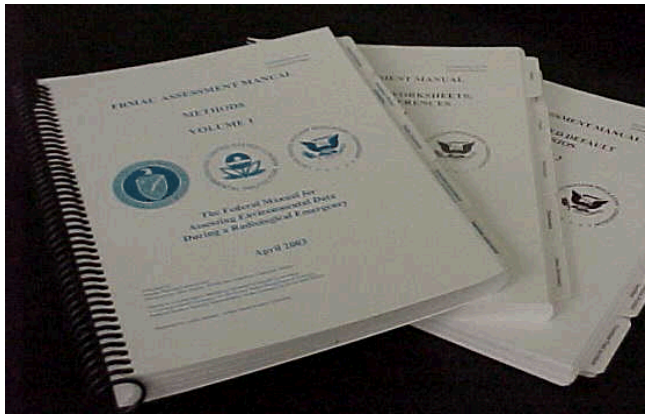
SNL CM Program Leadership

- Lead CM Assessment Scientist specialty
- Lead the development of CM/FRMAC Assessment Manual
- Provide deployable Assessment Scientists to CM Field Operations
- Provide technical expertise to all CM Technical Specialty areas (H&S, Lab Analysis, M&S)



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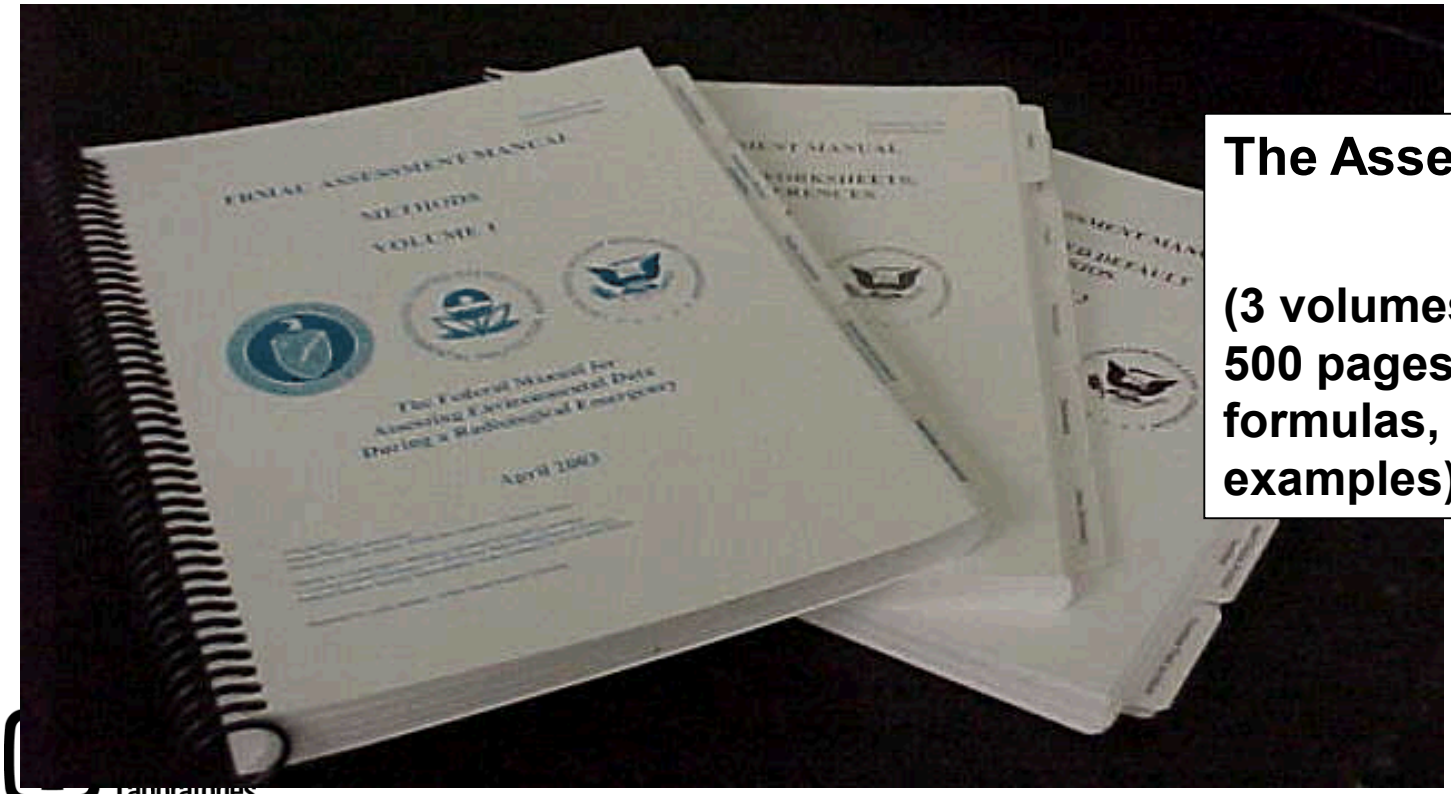
Turbo FRMAC Software Development

- Currently, Assessment Scientist has use the Assessment Manual to calculate the necessary radiological quantities.



The Assessment Manual

(3 volumes approximately 500 pages of equations, formulas, lookup tables and examples)

Turbo FRMAC Software Development

- Turbo FRMAC is computer programmed version of Assessment Manual.
  - Field deployable
  - Automatically, performs the calculations and table lookups in the Assessment Manual

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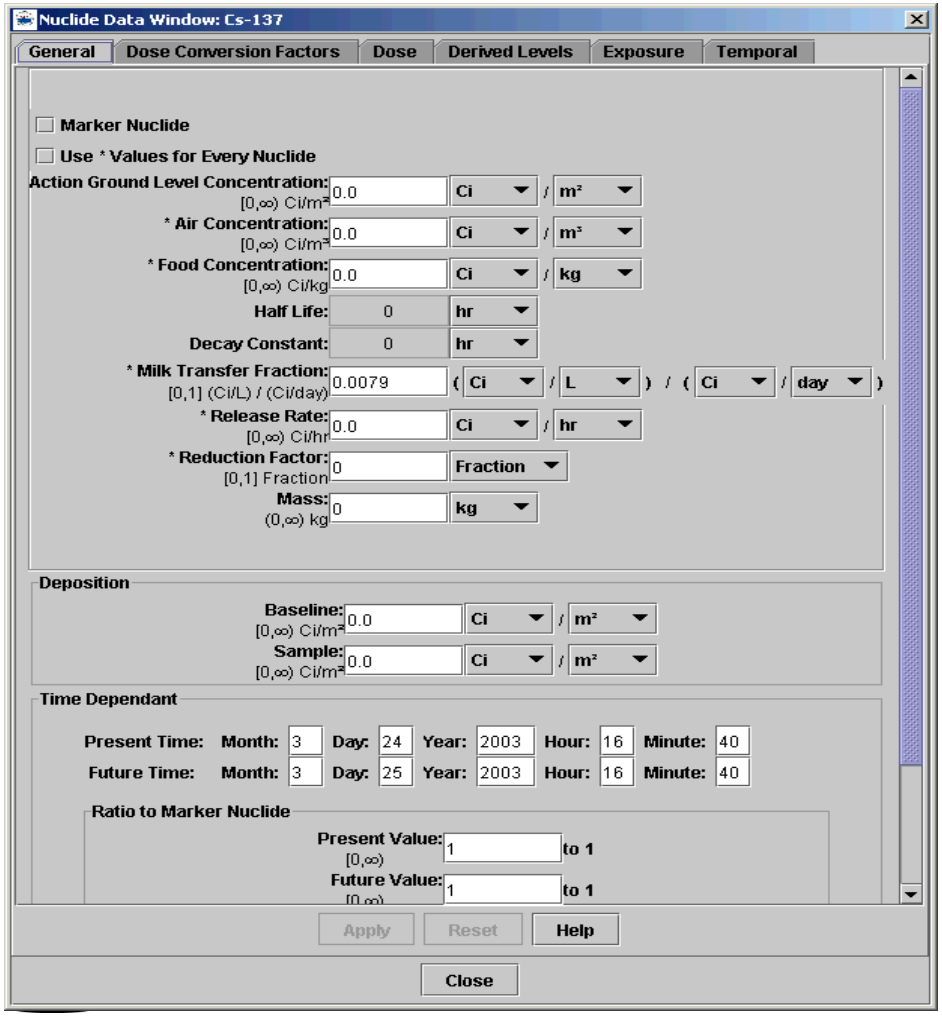
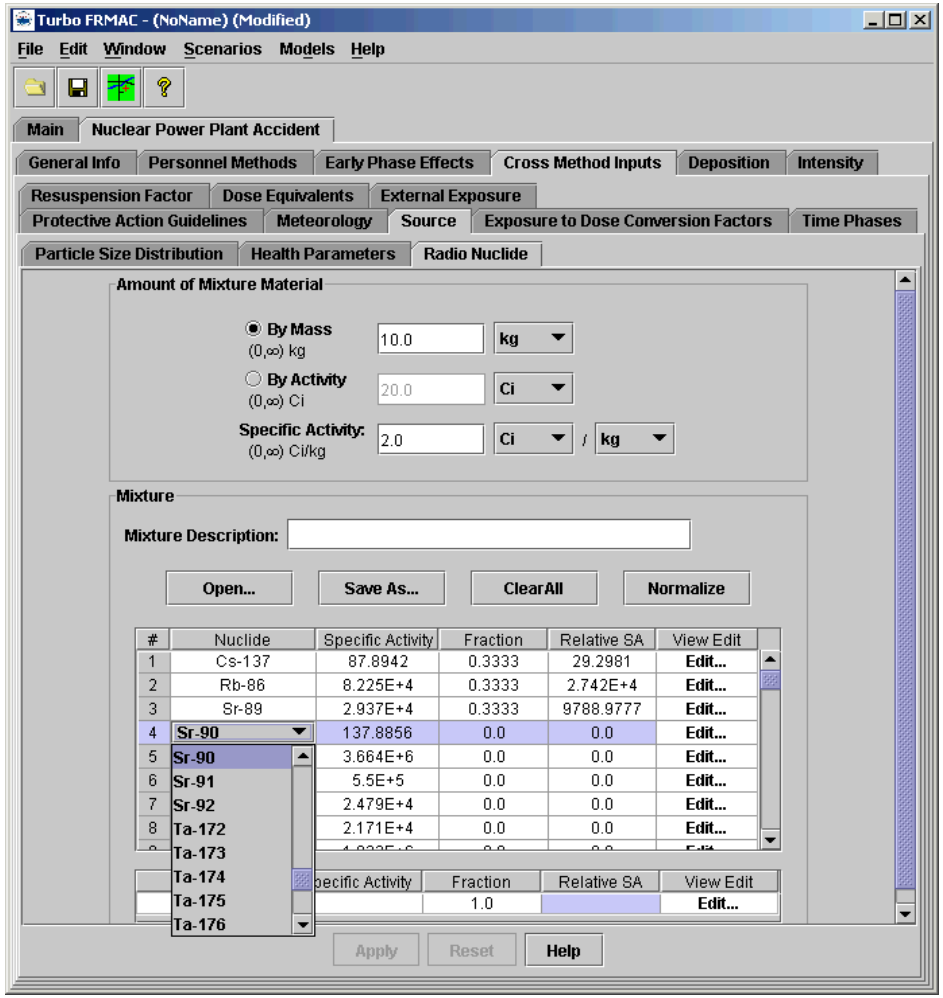
Turbo FRMAC Software Development

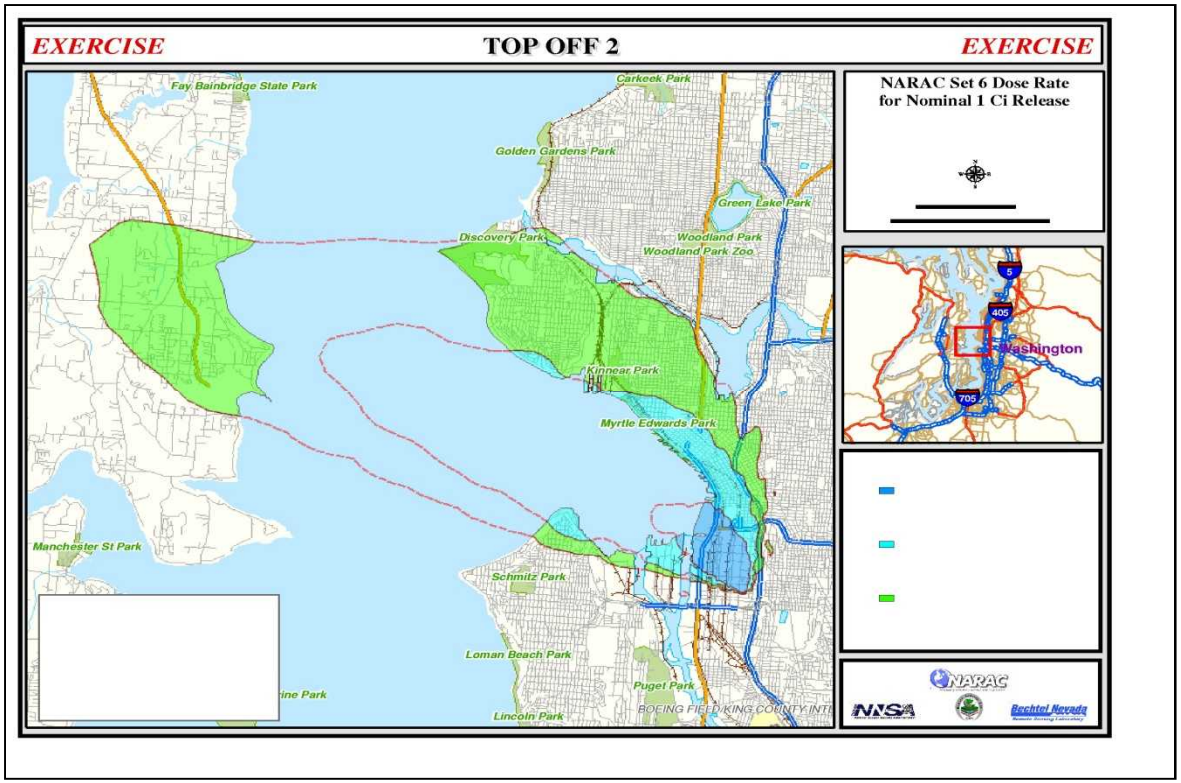
Menu Driven Interface





CM Exercise Planning

- **Use dispersal model tools to help develop plumes to be used for training exercises**
- **Participate in scenario development**



United States of America's Consequence Management Resources

The United States has Developed and Maintains Numerous Resources For Responding to Radiological Emergencies.

Advanced Preparations and Training are the Key to Successful Responding to a Radiological Emergency

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Questions?