

Using Project Risk Analysis to Counter Terrorism

**Symposium on Terrorism Risk Analysis
January 13-14, 2005**

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Terrorism Risk Analysis: Research Objectives

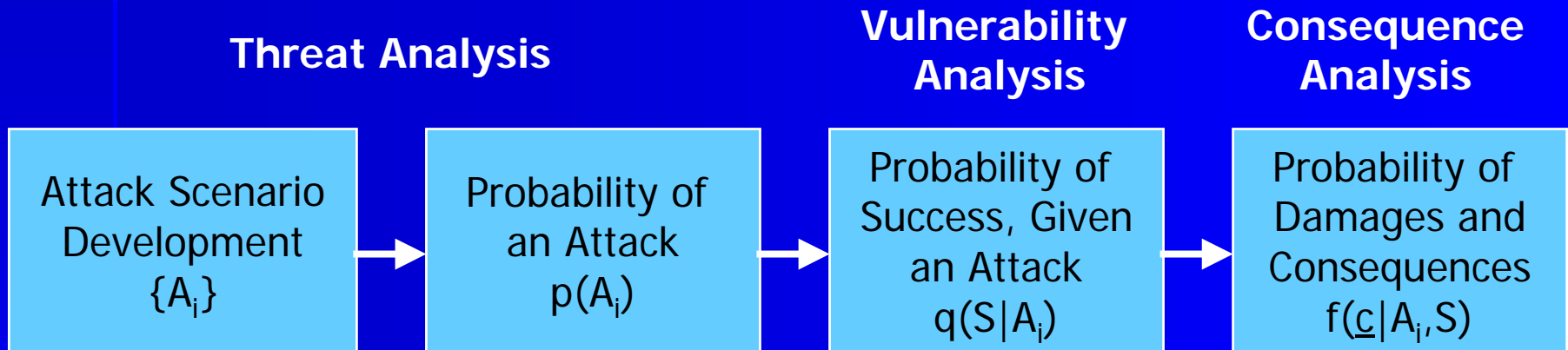
- To help anticipate a wide range of terrorist attacks
 - To estimate the likelihood of terrorist attacks
 - To estimate the consequences of successful terrorist attacks
-

To improve the allocation of resources to defend against terrorism

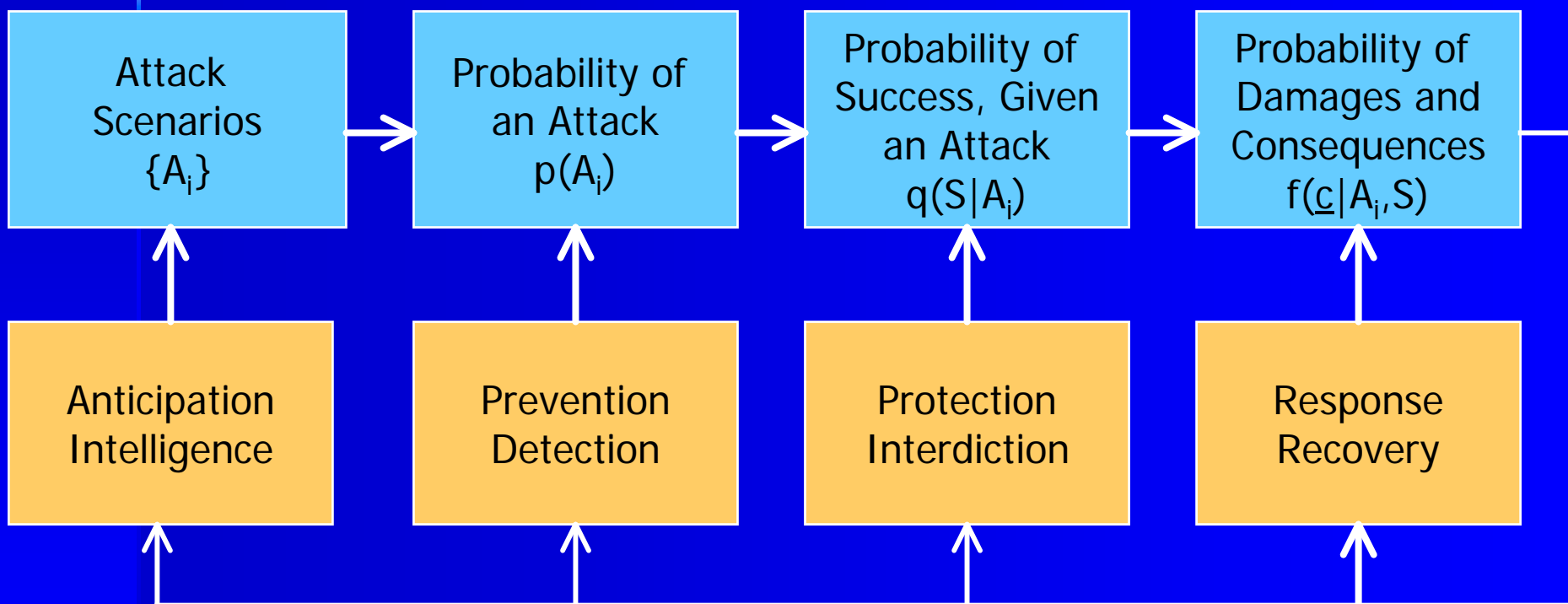
State-of-The Art

- 30 years of experience with risk analysis
- Many recent attempts to apply risk analysis to terrorism
 - Straightforward extensions of PRA
 - Vulnerability and risk scoring systems
 - Project risk analysis approaches
 - Influence diagrams approaches including motivations and capabilities of terrorists
 - Game theory and simulation games

Terrorism Risk Analysis



Risk Analysis with Interventions



CREATE Projects

Modeling Areas	Ports (Dirty Bomb)	MANPAD	Infrastructure (Electricity)
Risk Analysis			
Consequence Assessment			
Response Modeling			
Economic Analysis			

LA and Long Beach Ports



3rd busiest port in the world

36% of US imports

11.4 million TEUs per year

\$212 billion cargo value

The Dirty Bomb Project: Risk Analysis

- Develop attack scenarios: Sources x delivery mechanism x location
- Estimate relative probabilities: Project risk analysis
- Provide information for consequence analysis: Radiological source term etc.

Example Sources

- Medical and Research Facilities
 - Blood irradiator (1000 Curies)
 - Research irradiator
 - Industrial irradiator (10,000 Curies)
- Nuclear Waste
 - LLW
 - HLW
 - Spent Fuel (1 million Curies per fuel assembly)
- Special Nuclear Materials
 - Enriched Uranium
 - Plutonium

Three Source Scenarios

1. Theft of radioactive materials from a U.S. hospital (1,000 Ci)
2. Theft of a U.S. industrial irradiator (10,000 Ci)
3. Theft or purchase of spent nuclear fuel from a Russian reactor or reprocessing plant (200,000 Ci)

Scenario 3: Spent Radioactive Fuel from Russian Reactors

		TRANSPORTATION			
		Car/Truck	Ship	Train	Plane/Heli
LOCATION	Bridge				
	Ground				
	Elevated				

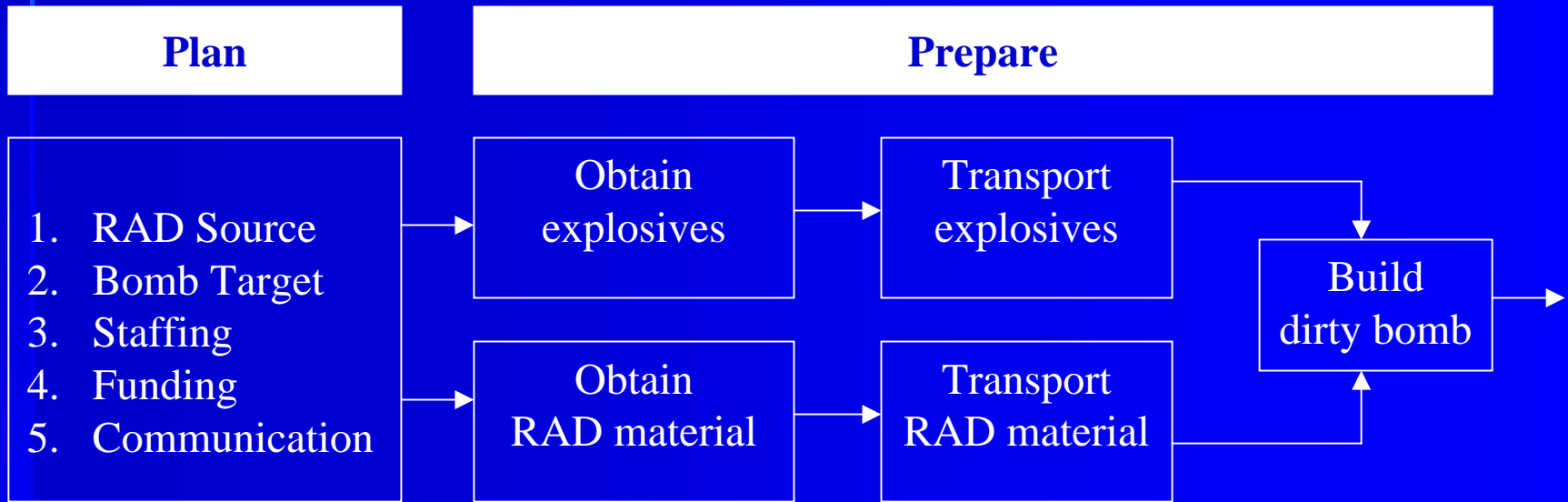
Scenario 2: Theft of an Industrial Irradiator

		TRANSPORTATION			
		Car/Truck	Ship	Train	Plane/Heli
LOCATION	Bridge	High	High	High	Low
	Ground	High	Low	Low	Low
	Elevated	High	Low	High	Low

Scenario 1: Theft from a Hospital

		TRANSPORTATION			
		Car/Truck	Ship	Train	Plane/Heli
LOCATION	Bridge				
	Ground	BETTER TARGETS AVAILABLE			
	Elevated				

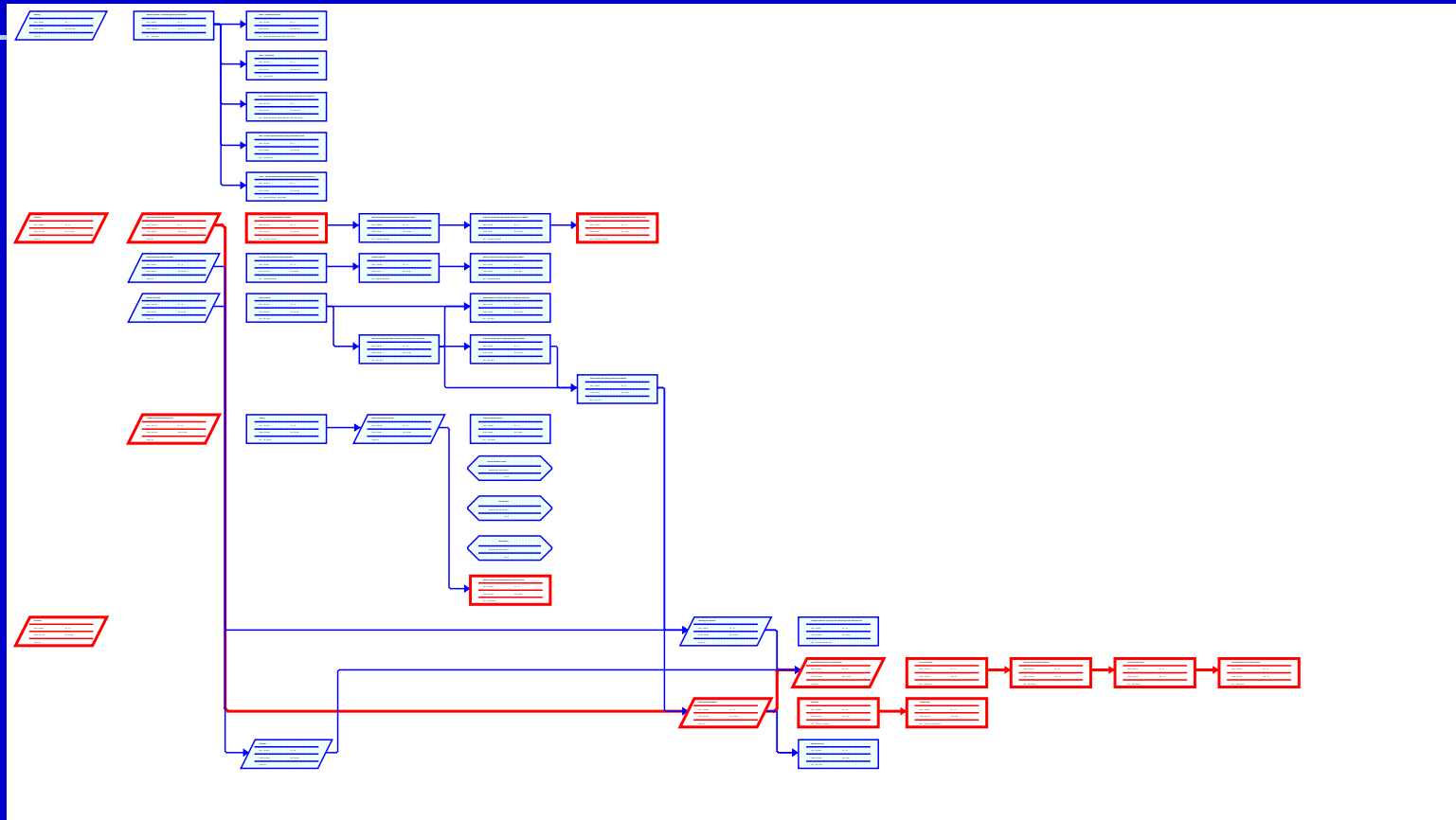
The Project Begins....



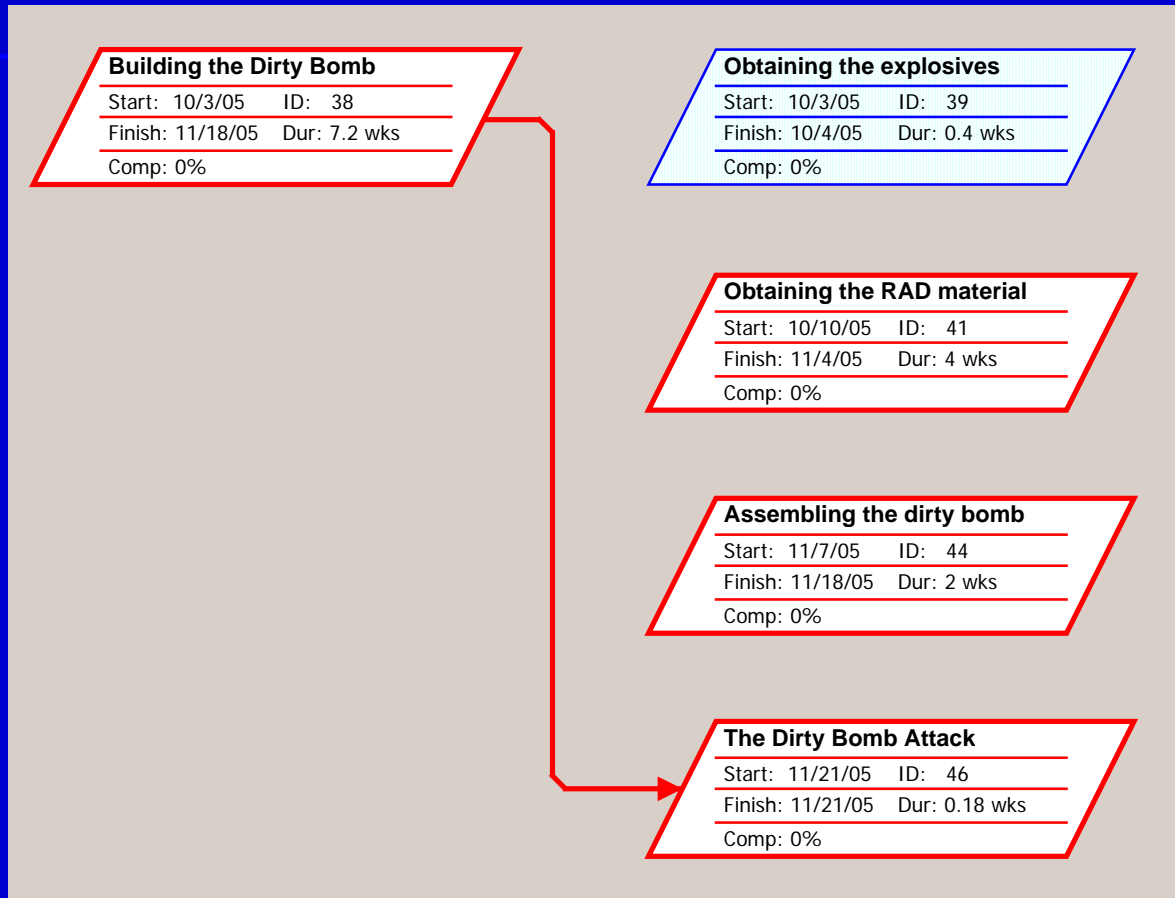
... and is completed



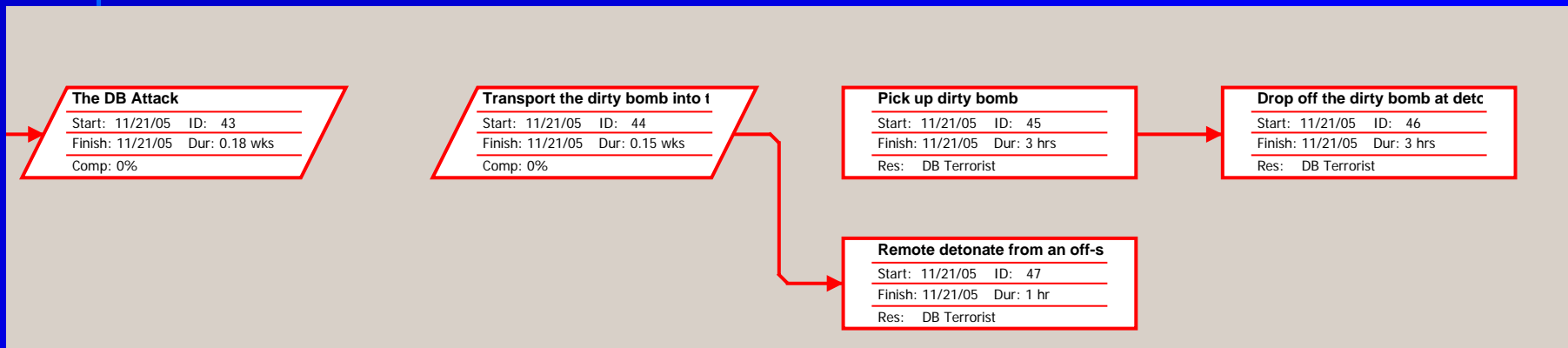
The Complete Project



Building the Dirty Bomb



The Dirty Bomb Attack



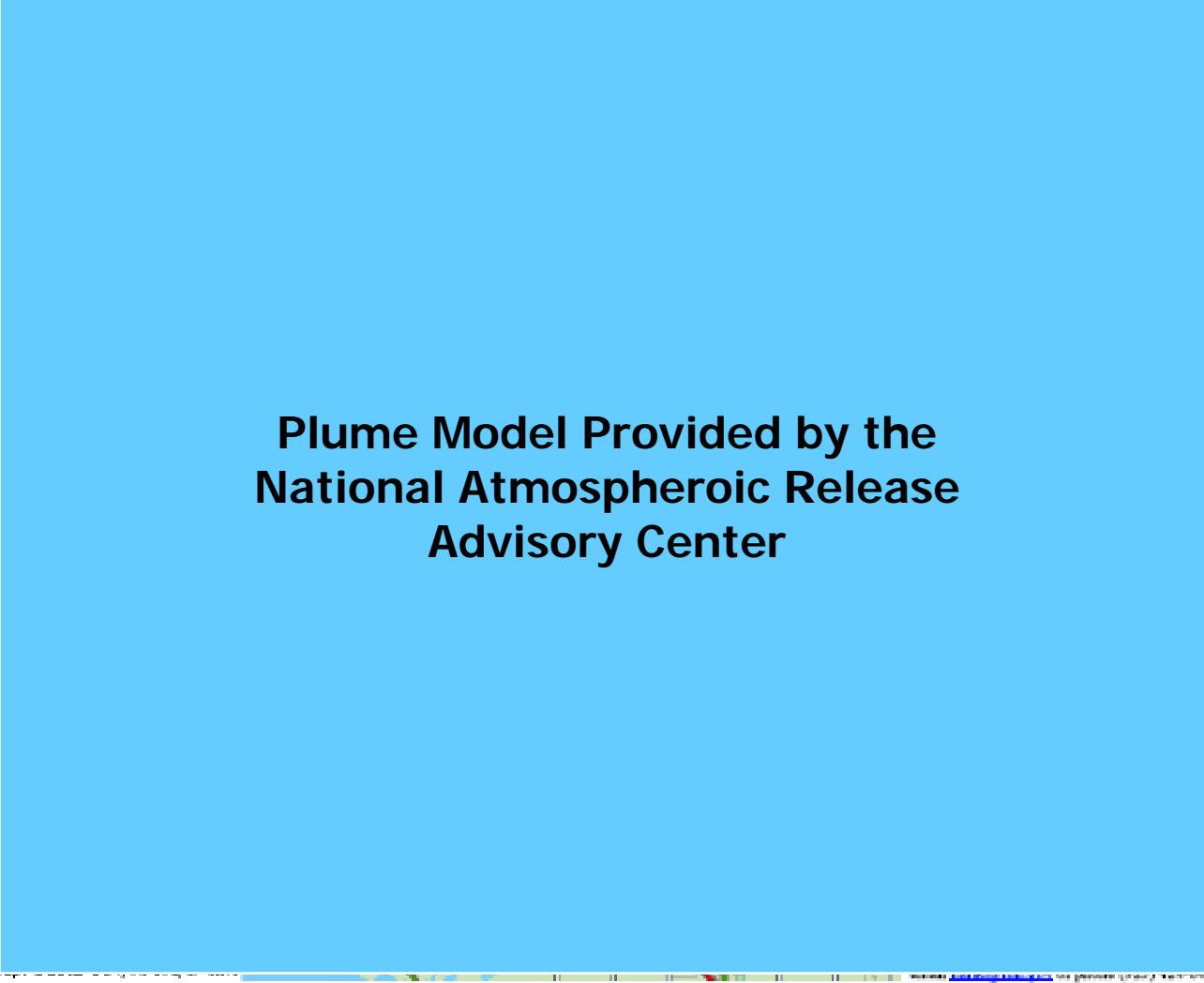
Output of Risk Analysis

- Probability of Success of Attack
- Probability distribution over source term
 - airborne and respirable
 - Solids and large particles

Consequence Assessment

- Short term consequences:
 - Fatalities and injuries from blast
 - Damage to structures from blast
 - Acute radiation exposure
- Medium Term Consequences
 - Shut down of port
 - Business interruption
- Long term consequences:
 - Latent cancers

4-day Total Effective Dose Equivalent



**Plume Model Provided by the
National Atmospheric Release
Advisory Center**

description
in. Evac. req. Respiratory req.
limit for lifesaving cancer risk
per limit PAC for
CI for considering
low PAC for considering

nd level

Rough Consequence Estimates: Cancer Deaths

- Scenario 1: A few
- Scenario 2: Tens
- Scenario 3: Hundreds

Dirty Bomb Project: Economic Modeling

- Inputs:
 - Short term closure of port
 - Long term closure of port
- Results:
 - \$138 million for 15 days closure
 - \$35 billion for 120 days closure

Countermeasures

- Radiation detection portals for trucks at entry points
- Inspection of containers including radiation detection
- Personal radiation detection devices

Preliminary Conclusions

- Project risk analysis is a viable tool
 - Can provide a roadmap of terrorist attacks
 - Can establish an upper bound of the probability of a successful attack
 - Can identify project vulnerabilities
- Challenges:
 - How to obtain the probability of attack
 - How to define project failure
 - How to assess failure probabilities

Future Work

- Complete dirty bomb scenarios and probability assessments
- Package project risk analysis “tool” and make available to DHS and others
- New:
 - Develop methodologies for $p(A_i)$ as a function of terrorists’ utilities and capabilities
 - Case study of nuclear device risks