Using Project Risk Analysis to Counter Terrorism

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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

Threat Analysis

- Attack Scenario Development \( \{A_i\} \)

Vulnerability Analysis

- Probability of an Attack \( p(A_i) \)

- Probability of Success, Given an Attack \( q(S|A_i) \)

Consequence Analysis

- Probability of Damages and Consequences \( f(c|A_i, S) \)
Risk Analysis with Interventions

- Attack Scenarios \( \{A_i\} \)
- Probability of an Attack \( p(A_i) \)
- Probability of Success, Given an Attack \( q(S|A_i) \)
- Probability of Damages and Consequences \( f(c|A_i,S) \)

- Anticipation Intelligence
- Prevention Detection
- Protection Interdiction
- Response Recovery
## CREATE Projects

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<th>Modeling Areas</th>
<th>Ports (Dirty Bomb)</th>
<th>MANPAD</th>
<th>Infrastructure (Electricity)</th>
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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

A table showing the transportation methods available for different locations:

<table>
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<tr>
<th>LOCATION</th>
<th>TRANSPORTATION</th>
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<tbody>
<tr>
<td>Bridge</td>
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<tr>
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## Scenario 2: Theft of an Industrial Irradiator

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<tbody>
<tr>
<td></td>
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<td>Ground</td>
<td></td>
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<tr>
<td>Elevated</td>
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Scenario 1: Theft from a Hospital

<table>
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<tr>
<th>LOCATION</th>
<th>TRANSPORTATION</th>
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</table>
| Bridge       | Car/Truck:  
|              | Ship:  
|              | Train:  
|              | Plane/Heli:  |
| Ground       | BETTER TARGETS AVAILABLE |
| Elevated     | Car/Truck:  
|              | Ship:  
|              | Train:  
|              | Plane/Heli:  |
The Project Begins....

Plan
1. RAD Source
2. Bomb Target
3. Staffing
4. Funding
5. Communication

Prepare
- Obtain explosives
- Obtain RAD material
- Transport explosives
- Transport RAD material

Build dirty bomb

The Project Begins....

Center for Homeland Security
U.S. Department of Homeland Security
... and is completed

Build dirty bomb → Transport dirty bomb to target → Detonate dirty bomb → Escape

Attack
Building the Dirty Bomb

Building the Dirty Bomb
Start: 10/3/05  ID: 38
Finish: 11/18/05  Dur: 7.2 wks
Comp: 0%

Obtaining the explosives
Start: 10/3/05  ID: 39
Finish: 10/4/05  Dur: 0.4 wks
Comp: 0%

Obtaining the RAD material
Start: 10/10/05  ID: 41
Finish: 11/4/05  Dur: 4 wks
Comp: 0%

Assembling the dirty bomb
Start: 11/7/05  ID: 44
Finish: 11/18/05  Dur: 2 wks
Comp: 0%

The Dirty Bomb Attack
Start: 11/21/05  ID: 46
Finish: 11/21/05  Dur: 0.18 wks
Comp: 0%
The Dirty Bomb Attack

The Dirty Bomb Attack
Start: 11/21/05  ID: 43
Finish: 11/21/05  Dur: 0.18 wks
Comp: 0%

Transport the dirty bomb into I
Start: 11/21/05  ID: 44
Finish: 11/21/05  Dur: 0.15 wks
Comp: 0%

Pick up dirty bomb
Start: 11/21/05  ID: 45
Finish: 11/21/05  Dur: 3 hrs
Res:  DB Terrorist

Remote detonate from an off-s
Start: 11/21/05  ID: 47
Finish: 11/21/05  Dur: 1 hr
Res:  DB Terrorist

Drop off the dirty bomb at deto
Start: 11/21/05  ID: 46
Finish: 11/21/05  Dur: 3 hrs
Res:  DB Terrorist
Event Tree
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
Plume Model Provided by the National Atmospheric Release Advisory Center
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