

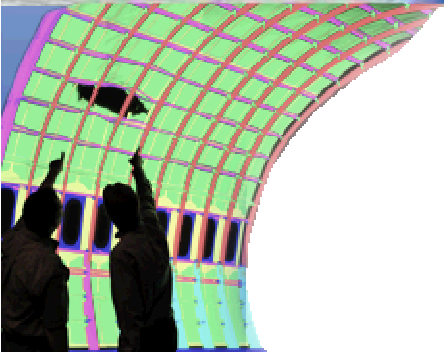


Sandia National Laboratories

Date 06/22/11

Chemical Supply Chain Resilience and Security

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A Request for Analytical Capability

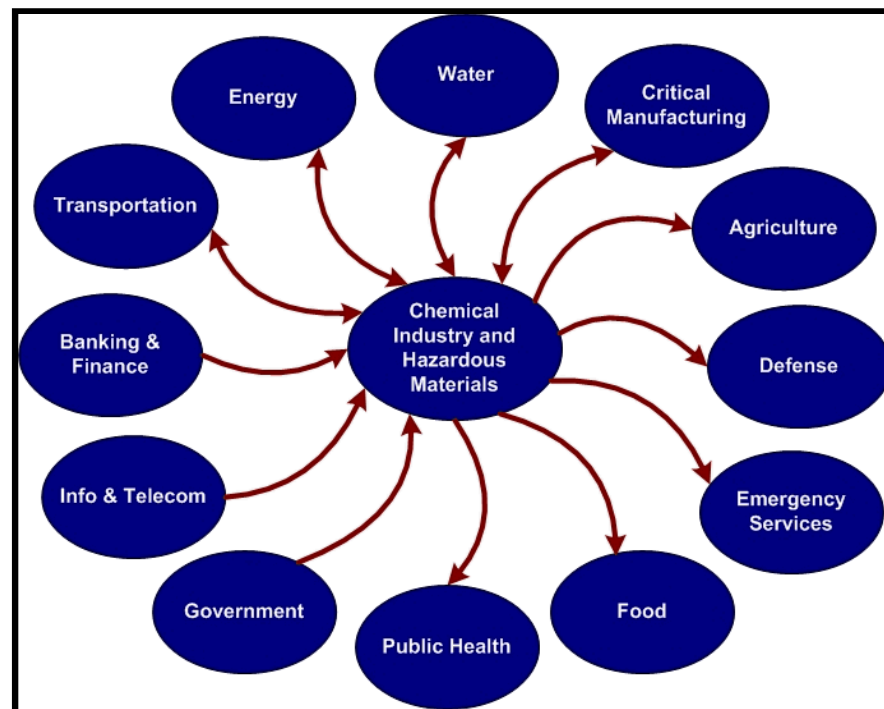
- **Chemical Sector designated critical infrastructure in 2006**

- DHS IP requested chemical supply chain analysis capability

- **DHS S&T assumed project direction and funding in 2008**

- **This effort leverages Sandia's expertise in**

- Chemical engineering
- Infrastructure modeling & analysis
- Economics
- Computer science



The chemical sector is highly connected to other critical infrastructures.



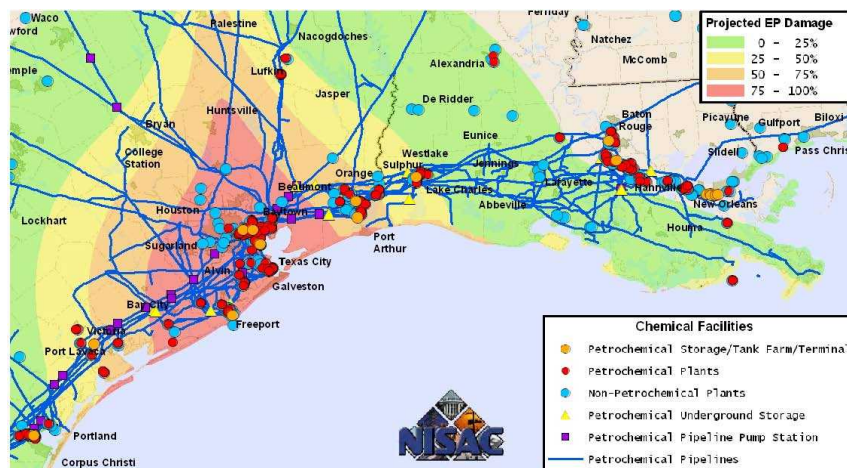
Scope

- Global, national, regional, and facility perspectives
- Disruptions to the chemical sector and dependent infrastructures



The chemical industry is truly a global market.

- Rapid, incident response
- Long-term, cascading impacts

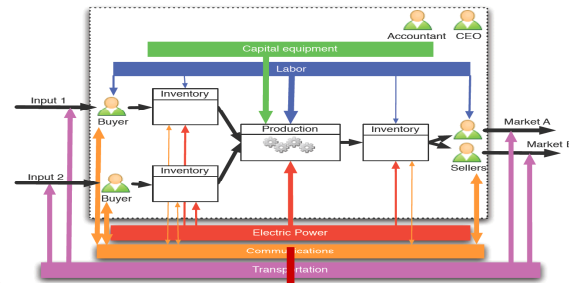
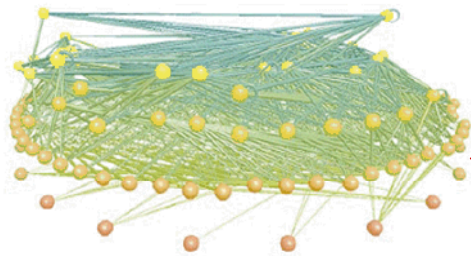


Incident response is a key use of the capability.

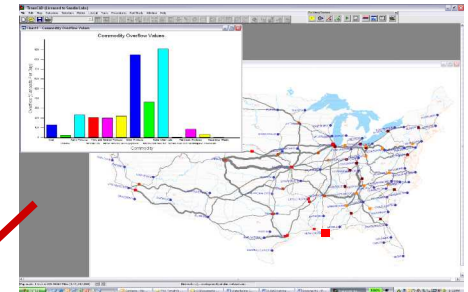
Capability Development

Supply Chain/Economic Analysis

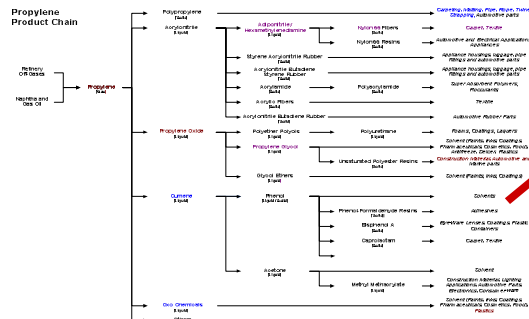
Network Analysis



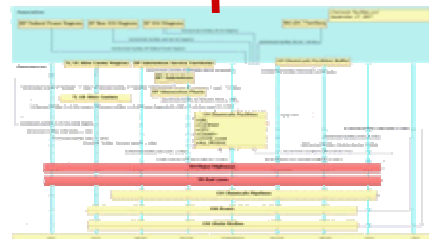
Transportation Analysis



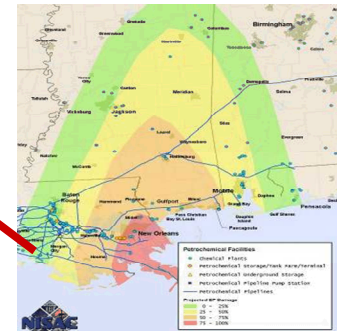
**Leveraging existing
NISAC models and
industry data in
combination**



Systems Analysis



Infrastructure/Interdependences Analysis



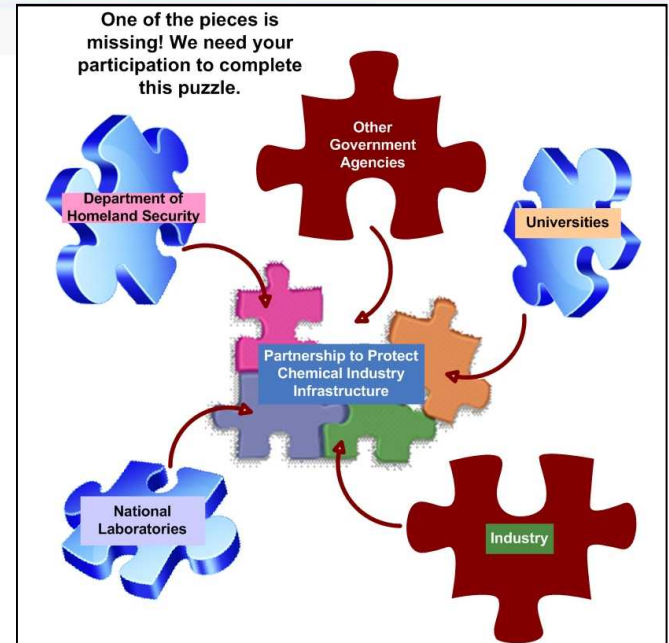
Geospatial Analysis

Application and Transition

- Supported DHS IP analysis requests, as staged validation and development permits
- Capability application examples include
 - Hurricane Dean (and many others)
 - Deep Water Horizon
 - National Level Exercises
 - Super Bowl 43



Hurricane Hannah 2008



Industry workshops validate methods.

- Formal capability transfer to DHS Risk Development and Modeling Branch in August, 2011
- Transition plan includes
 - User training workshop
 - User documentation



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Resilience Assessment

- **DHS recognized the need for defensible assessment methods**
- **S&T tasked Sandia in 2008 to develop such methods for infrastructure and economic systems**
- **Requirements**
 - Broadly applicable
 - Scientifically defensible
 - Peer-review

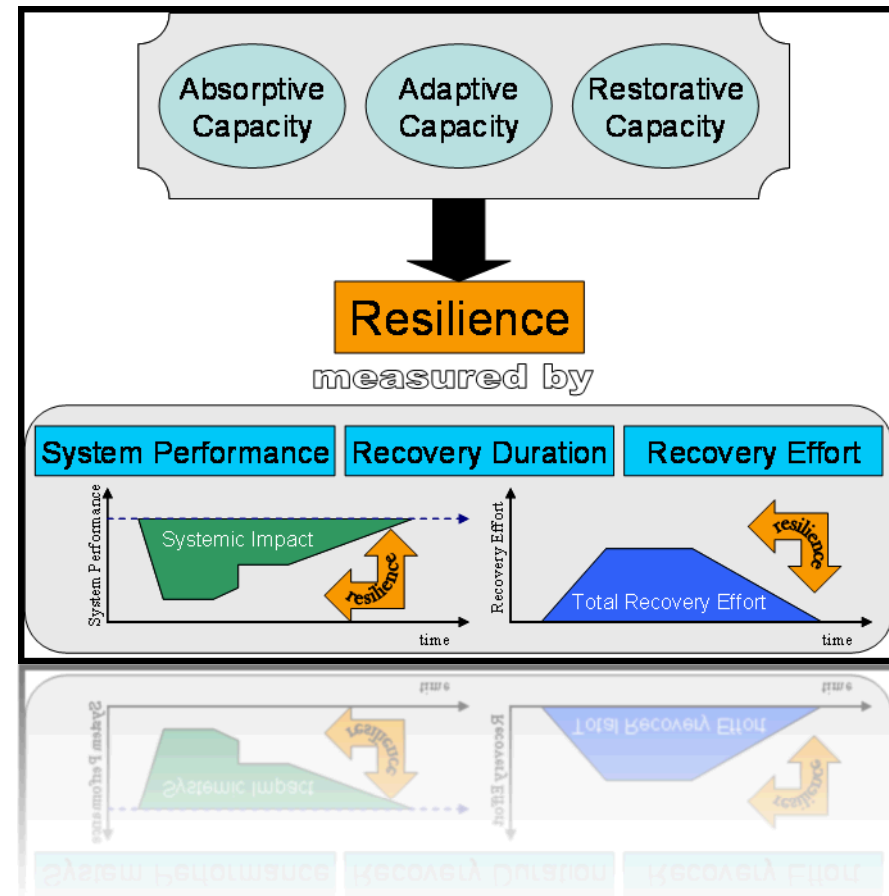
Infrastructure systems face a number of threats.



A Framework for Resilience Assessment

■ Key features include

- Mathematics of control theory
- Recovery costs and constraints
- Applicable to all infrastructure systems
- Qualitative and quantitative analysis
- Can handle dependencies

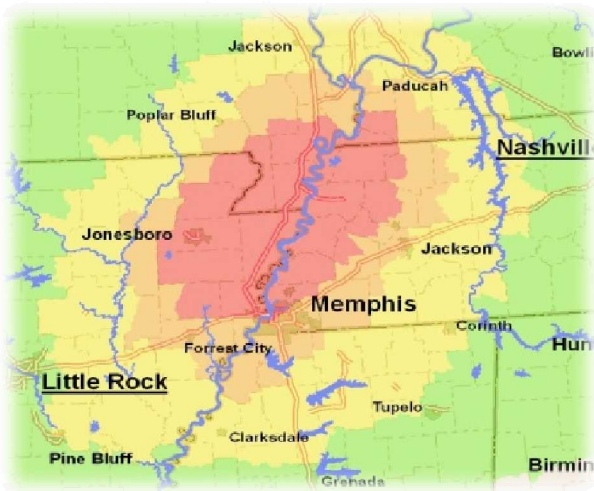




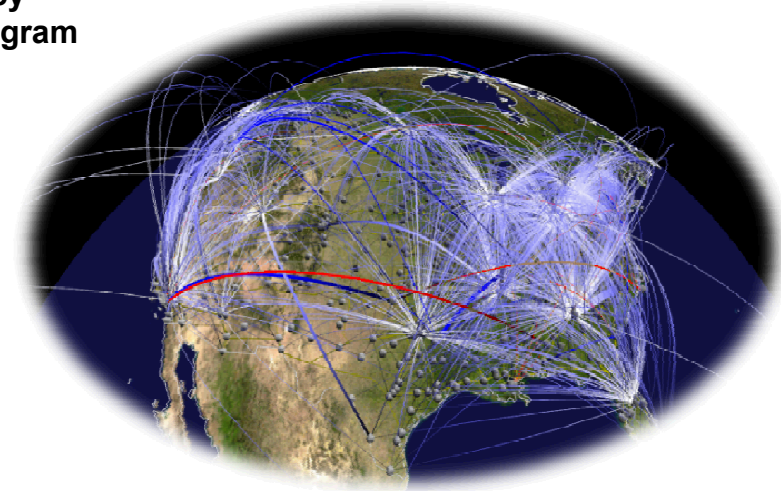
Example Applications



**Standards for DHS Policy
Resilience Certification Program**



**New Madrid Earthquake Analysis for
DHS IP**



Chemical Supply Chains for SSA



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