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NISAC Chemical Infrastructure Analysis Capability Overview

Briefing to Russell Heinen, SRI Vice President

by

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Objectives of Briefing

- Provide an overview of on-going chemical sector activities in NISAC
- Intended as background to assist in the identification of joint SRI-Sandia work opportunities, e.g.
  - Guidance on specific project deliverables
  - On-going project advisement
  - Future work

Briefing Outline

- DHS-funded project
  - Scope, Context, Phases, Data, Models, Workshop
- CRADA/LDRD Idea
  - Motivation, Technologies, Benefit
- Next steps

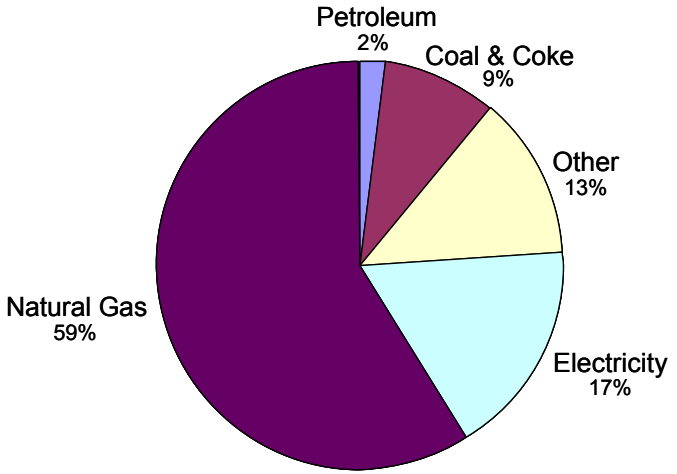
Programmatic Purpose and Scope

NISAC is developing chemical infrastructure analysis to assist DHS with

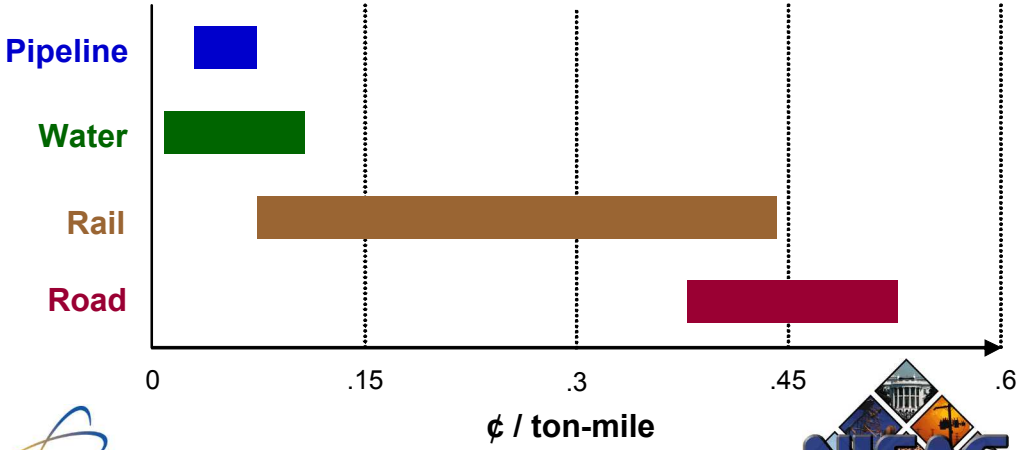
- Asset Prioritization
  - Provide definition of economically critical for the chemical sector
- Consequence Analysis
  - Provide capability for consequence analysis from national, regional, and facility perspectives from disruptions of the chemical sector and/or interdependent infrastructures
- Policy Analysis
  - Provide capability to analyze consequences of policy decisions at the sector and sub-sector level.

Infrastructure Context- a "NISAC Problem"

- Chemical Sector is highly interdependent on multiple infrastructures
  - Electric power
  - Petroleum
  - Transportation
  - Telecommunications
  - Banking & Finance



Percentages of total power (electricity and heating) consumption (BTUs) by source for the chemical industry



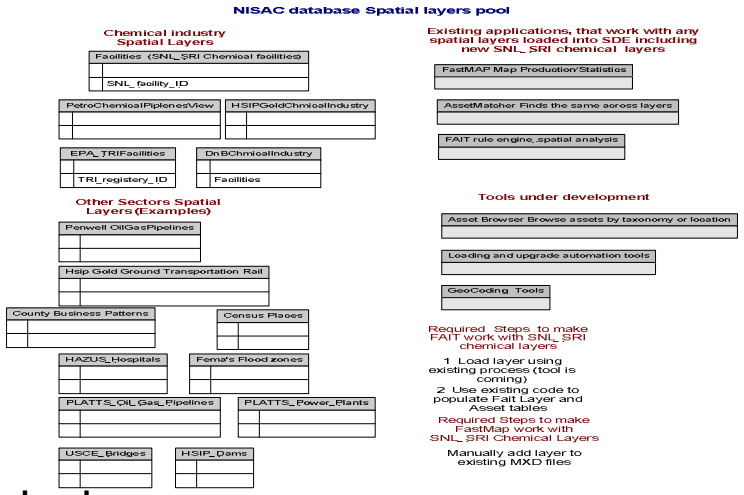
Example multiple infrastructure utilizations: energy and transportation

Current Chemical Project Phases

- Phase 1
  - Development of prototype capability (petrochemicals)
    - Data model definition
    - Implementation of data model within multiple NISAC tools
    - Industry workshop and feedback (June 2007)
    - Chemical sector analysis design completion (August 2007)
- Phase 2
  - Prioritize remaining chemical sectors
  - Data collection and analysis
  - Integrate into data model

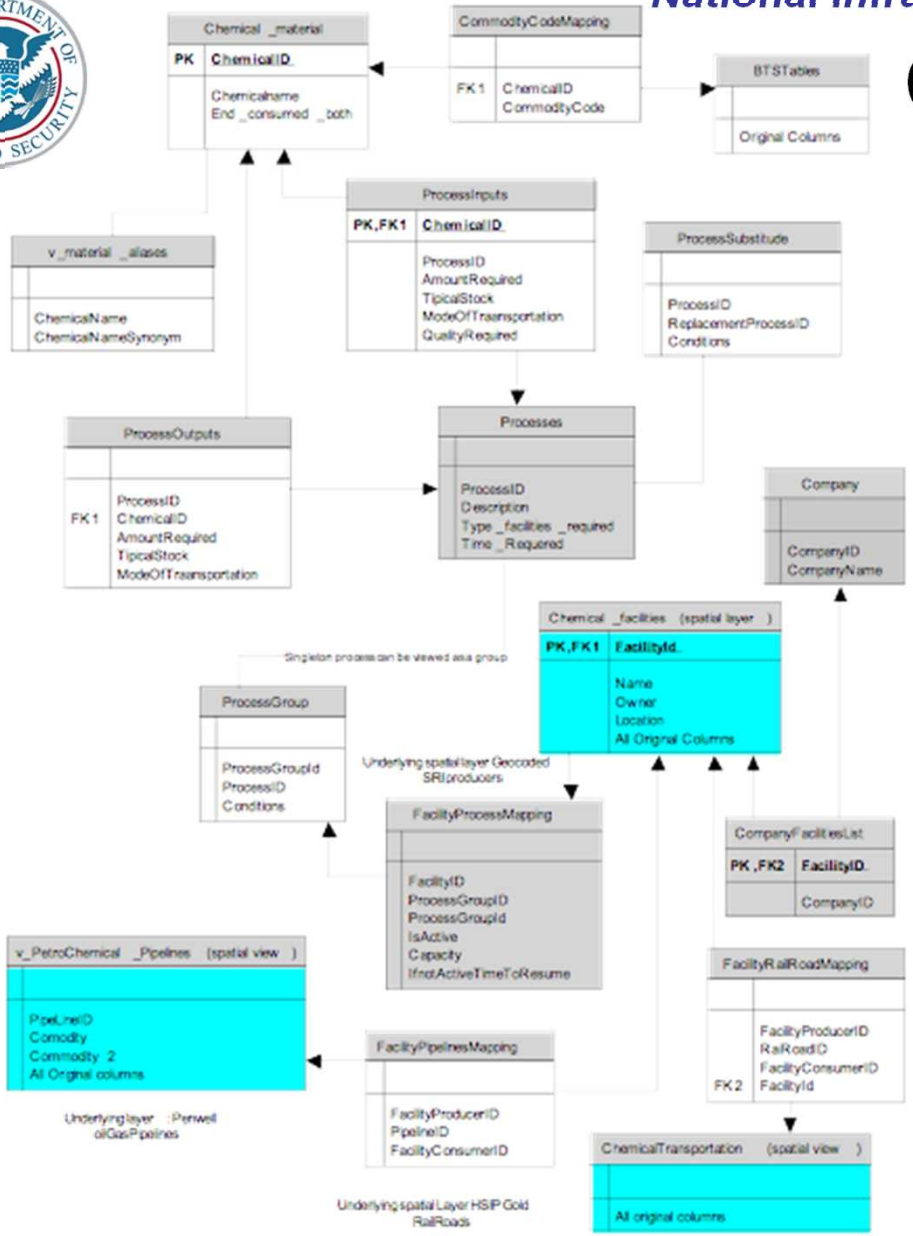
Data Driven Approach

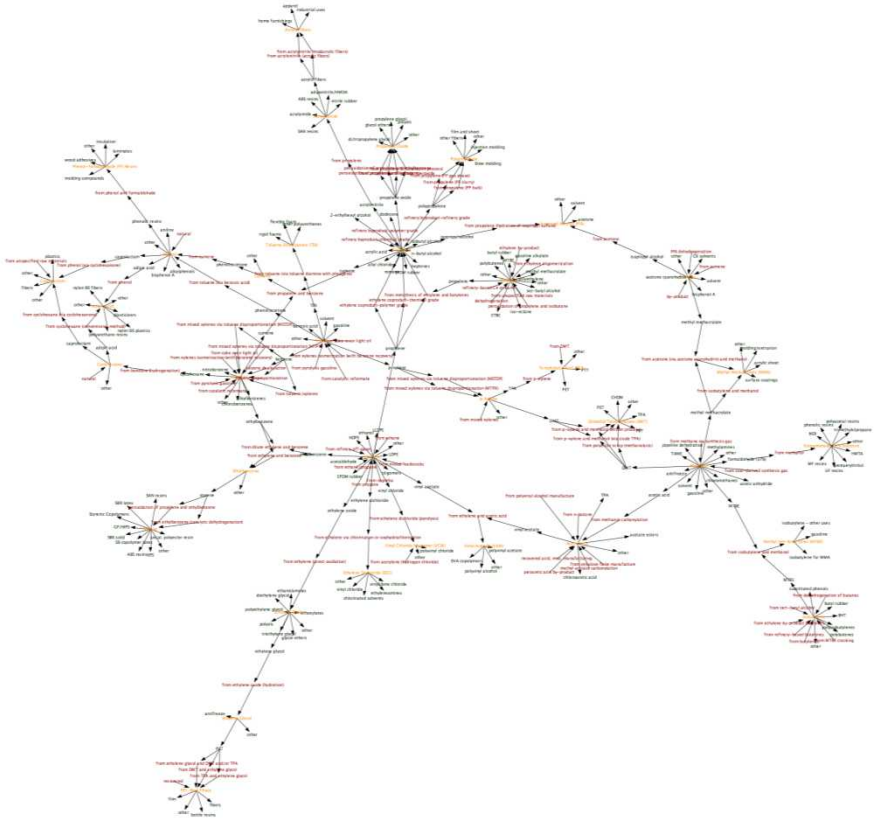
- Unified Chemical Sector Data Model
  - Plant facilities
  - Productions
    - Chemical type
    - Volumes
    - Process where appropriate
    - Interdependencies on other chemicals
  - Consumption
    - Competition/substitution (phase 2)
  - Imports/Exports
  - Other Infrastructure Interdependencies
- Fusion of SRI, HSIP, Penwell, CBP, Census, HAZUS, FEMA, PLATTS, and IMPLAN data



All models are driven from the same set of core input data. Differences in output are due to modeling approaches, not disparate input sets

Chemical Sector Data

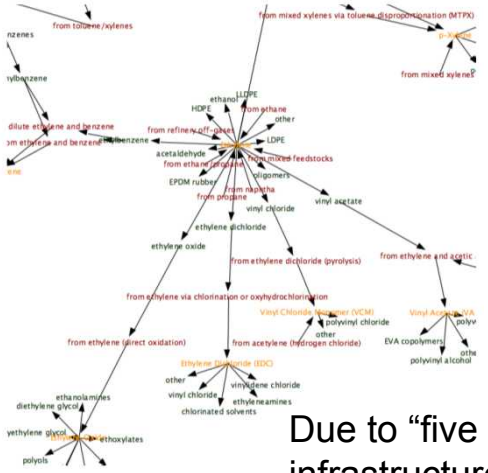




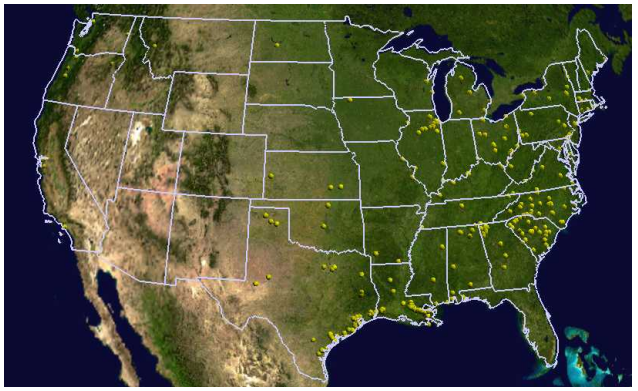
Data combined to give a unique system level characterization

Multiple Perspectives -- Multi-faceted Problem

- DHS needs to understand system in degraded state, under new operating rules
- Use existing NISAC models and Industry data in combination.
  - Network models
  - Economic models
  - Transportation models
  - System dynamics
  - Other NISAC data models



Due to “five 9” reliability of infrastructure in U.S., no sector-specific expert exists with knowledge of degraded system -- hence need for mod/sim



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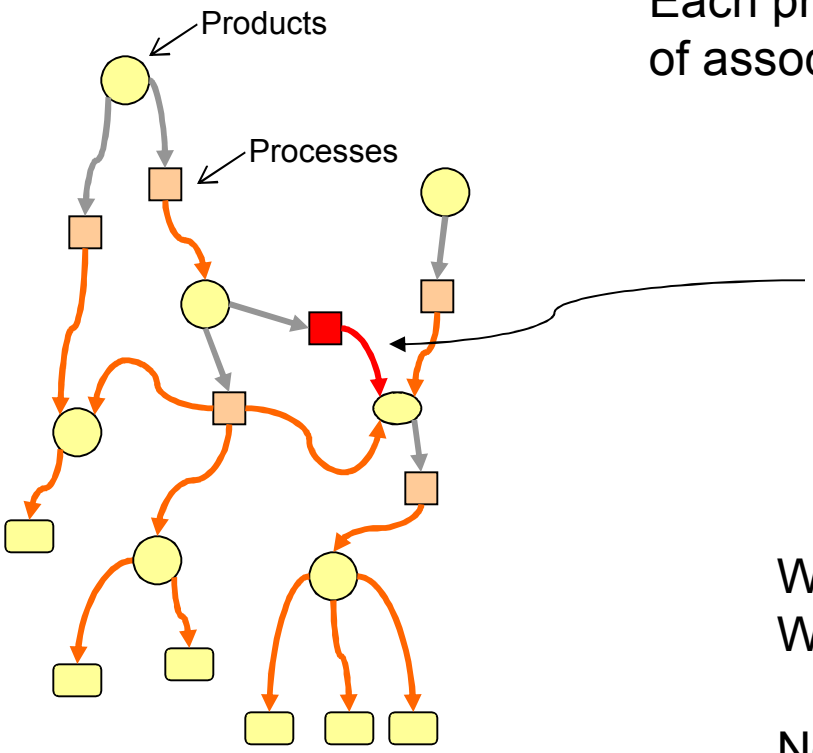
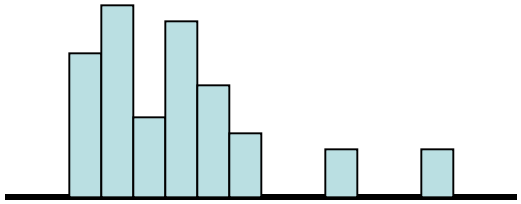
NISAC Network Model Application



Each process/product link has a *population* of associated producing firms



Capacity

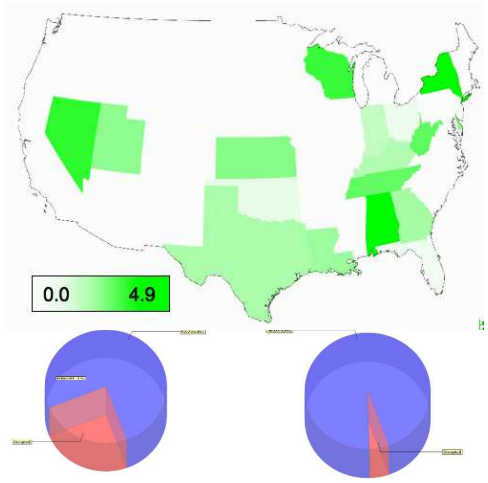
What if an average firm fails?
What if the largest fails?

Nonlinear impacts on final demand

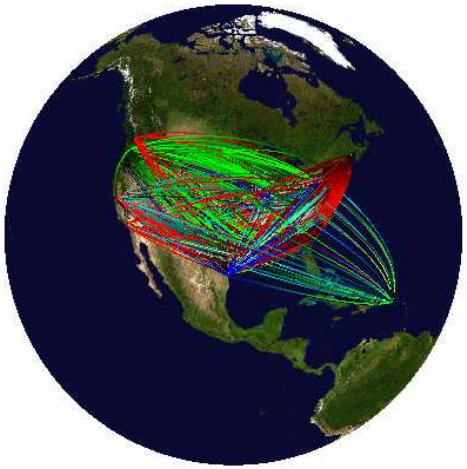
Multiple network representations: Products to Products, Processes to Processes, Combined

Economic Model

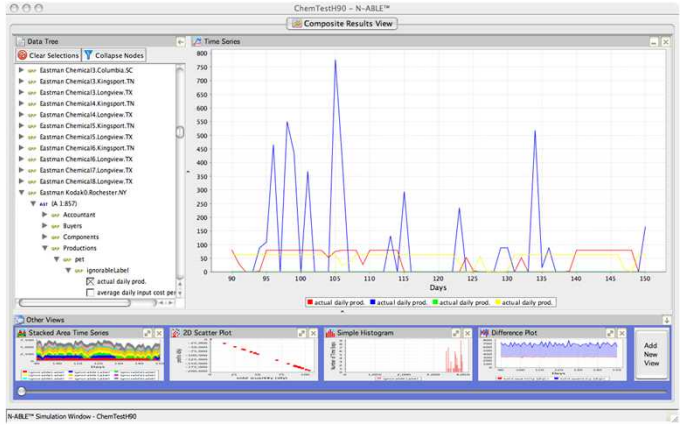
- Geospatially located firms, with supply chain dependencies and transportation, create, exchange, and consume chemicals



Scenario Inputs



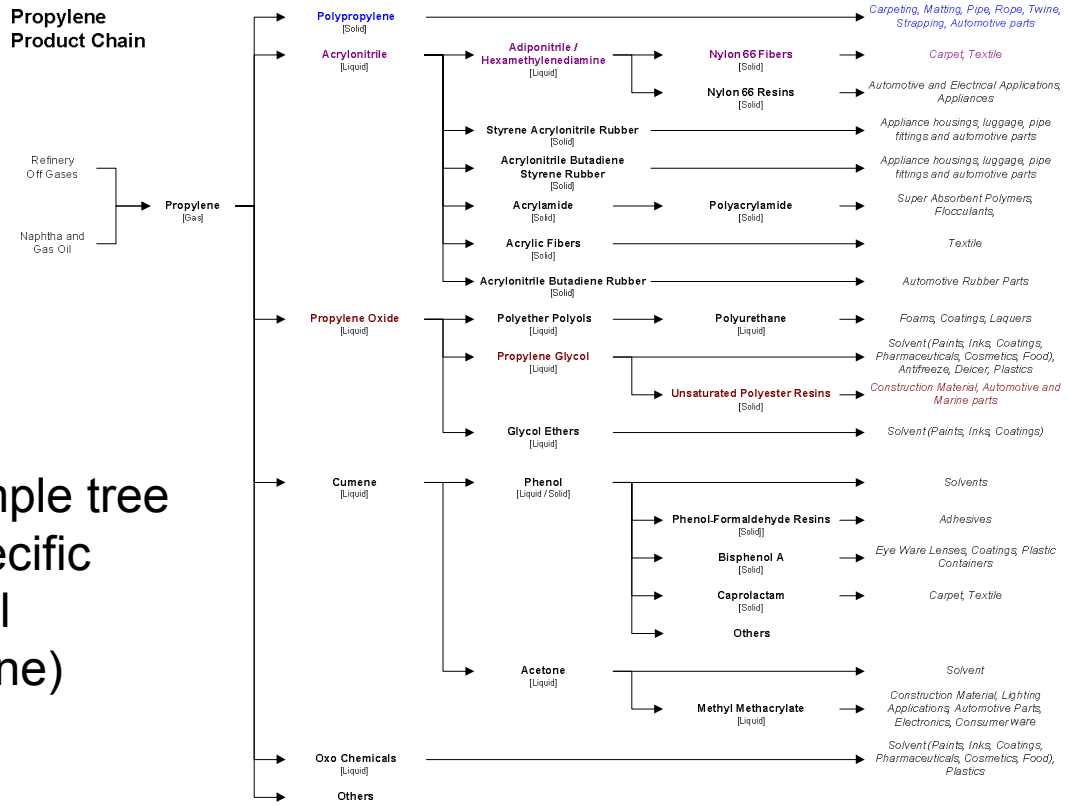
Simulation



Predicted Results

Systems Dynamics Model

- Product tree view from systems level gives downstream impacts



An example tree for a specific chemical (propylene)

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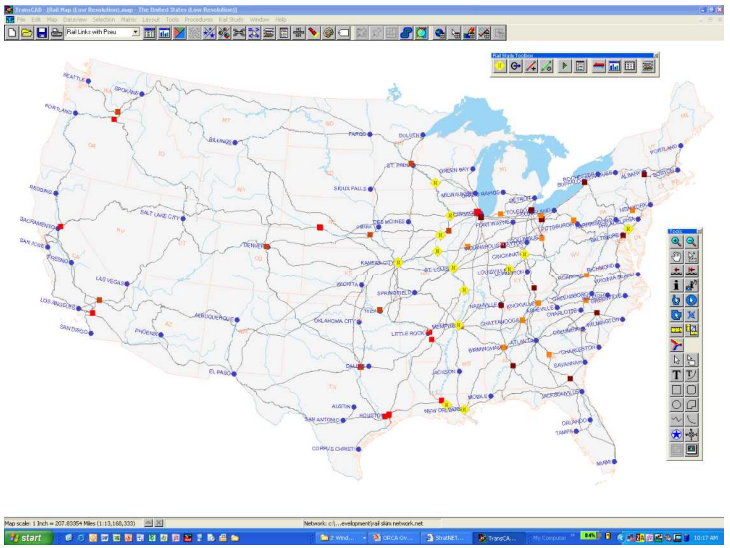
Transportation Model

- Predict most likely source-destination flow, transportation mode per chemical

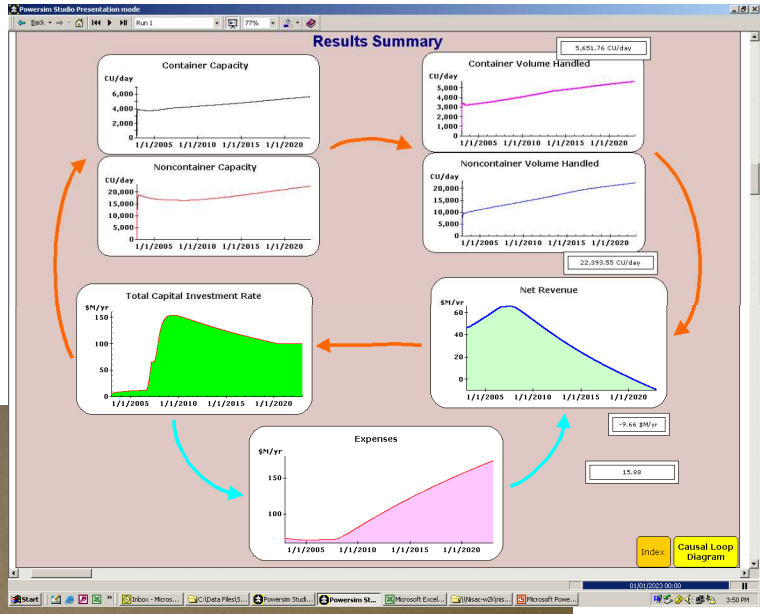
  - Commodity Data by Rail
    - All commodity data based on 2001 STB Waybill Sample
    - Commodities defined by 7 Digit Standard Transportation Commodity Codes (STCC)
    - STCC's aggregated into 13 Commodity Groups
    - Commodity Groups can be redefined as necessary
  - Four major railroads represented (UP, BNSF, CSX, NS)
  - Represents:
    - ~85% of carloads and tons originated on rail system
    - ~90% total freight revenue
  - Main rail transport corridors utilized

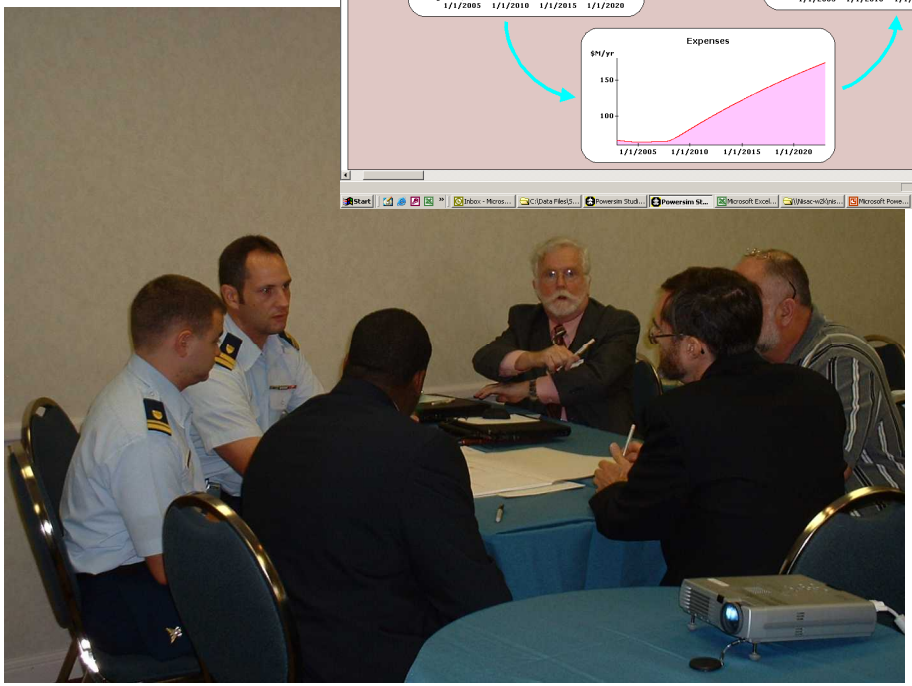


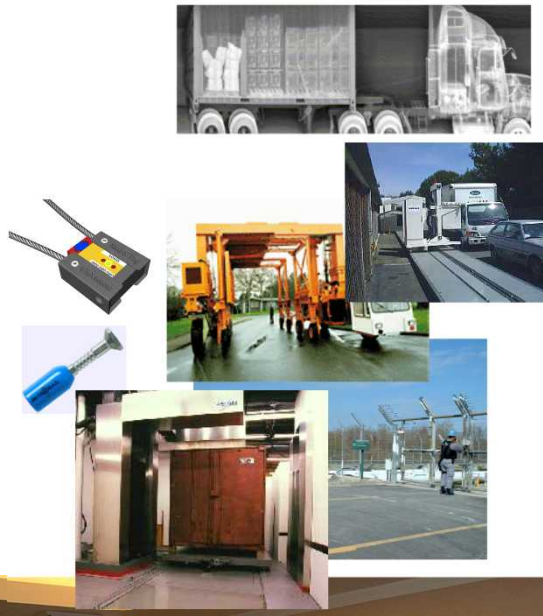
Industry Workshop

- NISAC has extensive experience using workshops to help define and explore multi-dimensional tradeoffs with diverse stakeholder groups.
- Approach
  - Developed models in collaboration with domain experts
  - Engage diverse stakeholder representatives
- Models engender more insight when used as the basis for a meaningful discussion between the disparate stakeholder groups (private industry, trade organizations, industry lobbying groups, etc.) than when exercised computationally
- “I will never lead a modeling effort that does not incorporate an interactive workshop with key stakeholders”
  - Theresa Brown, NISAC Program Manager

Example Workshops



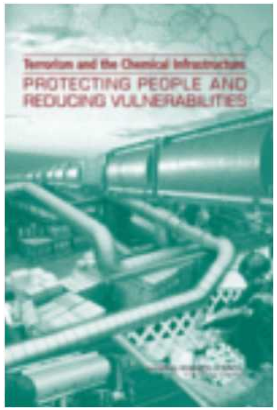




Proposed Workshop Theme

- RECOMMENDATION: DHS should support research to determine the combinations of incentives and disincentives that would best encourage the private sector to invest in safety and security. This will require research to identify the nature of the interdependencies and weak links in the supply chain and consideration of public-private partnerships to encourage voluntary adoption of protective measures by the weakest links in the chain.

  - NAS 2006 Study of Chemical Sector, p. 8



Questions on NISAC Chem Project

Genesis of LDRD Idea

- Idea based on the following observations:
  - NISAC is spending a lot of time formatting, fusing data; many data are in inconvenient formats (PDF notably)
  - Commercial entities have a business model for gathering, maintaining, and formatting data
    - SRI Consulting
  - A CRADA (or other WFO mechanism) with commercial information vendors could allow these vendors to build and maintain the canonical representations
  - Effective CRADAs require joint engagement

FY 08 LDRD Idea - DHS IAT

- LDRD Idea 08-0826: Joint Development of Economically Self Sustaining Chemical Sector Commercial Data Sources
- Problem: Long term access to high quality data, in a format requiring little to no work to feed models, for minimal cost
- Proposed R&D (Prove): Database design for data fusion, Semantic technologies for optimal mapping, Ethnographic design for system
- Benefits: Improve Sandia's "Brand" in Chem; Strategic Partnership (SRI); Lower cost (buy rather than build)

LDRD/CRADA Status

- Department 9200 supporting CRADA initiation efforts
- FBO advertisement placed on March 27, solicitation number 07-297
  - http://www1.fbo.gov/spg/DOE/SNL/SN/07%2D297/listing.html
- Initial negotiation with SRI underway
- Initial internal funding request for Sandia participation rejected April 12
- Second, smaller funding request submitted to Sandia VP for DHS programs

Questions on LDRD/CRADA

Near Term Opportunities

- We could use expert assistance on the Industry Workshop
  - SME Review of proposed structure and content
    - Mid May dry run -- ORNL Networking opportunity
  - SME Presence at workshop (mid June)
  - Facilitation and “knowledge capture” at workshop
  - Appropriate contacts to inform of workshop and invite?
- SME Review of various NISAC models

Final Questions

- Who else should we be talking to?
- Are there other resources we should be drawing on?
- Other partnering opportunities?
  - Individual facility risk-based assessments
  - “Situated facility” assessment (new concept)
  - System level environmental impact minimization

End of Prepared Slides