Utility Infrastructure, Interdependencies, and Integration with Government and Critical Lifelines in Emergencies

Presented by:
Don Boland
Executive Director
California Utilities Emergency Association
“Common Threads”

Integrating Public/Private Partnerships into the Emergency Management System

Mutual Assistance Across Multiple Utility Lifelines
California Emergency Management Agency

- California Emergency Management Agency (Cal EMA)
- State Agency support
- Three Administrative Regions
  - Coastal (Oakland)
  - Inland (Sacramento)
  - Southern (Los Alamitos)
- Six Mutual Aid Regions
  - Law, Fire
CUEA

• History
  • Created in 1952 as the Utility Policy Committee
  • Incorporated Private Non-Profit status 1998

• Purpose/Mission
  • Voluntary organization
  • Focus on mutual assistance, all hazard planning, coordination, communication in emergency planning and disaster response

• Includes representatives of each infrastructure
  • Energy (Electric, Gas, and Pipeline)
  • Telecommunications (Local Long Distance and Cellular)
  • Water and Wastewater
Our Critical National Infrastructures Are Mutually Dependent and Interconnected
Interdependencies Between the Eight Critical Infrastructures
Types of Interdependencies

- Physical (e.g., material output of one infrastructure used by another)
- Cyber (e.g., electronic, informational linkages)
- Logical (e.g., dependency through financial markets)
- Geographic (e.g., common corridor)
Understanding Interdependencies

- Importance to the operation of the infrastructures
  - Normal operations
  - Disruptions (including coincident events)
  - Repair and restoration

- How interdependencies change as a function of outage duration and other factors

- What linkages exist between critical infrastructures and community assets

- How backup or other mitigation mechanisms can reduce interdependence problems
Interdependencies Considerations

• The new technology—increasing reliance on information technology and telecommunications

• Interdependencies transcend individual public and private sector companies—and are not well understood

• Infrastructure linkages vary significantly in scale and complexity - local, regional, national, international

• Gaps exist in capacity to analyze multiple contingency events involving interdependent infrastructures

• Understanding interdependencies requires identifying how each infrastructure depends on, or is supported by, each of the other infrastructures
Types of Interdependencies Related Disruptions

- Cascading failure – a disruption in one infrastructure causes a disruption in a second infrastructure

- Escalating failure – a disruption in one infrastructure exacerbates an independent disruption of a second infrastructure (e.g., the time for recovery or restoration of an infrastructure increases because another infrastructure is not available)

- Common cause failure – a disruption of two or more infrastructures at the same time because of a common cause (e.g., natural disaster, right-of-way corridor)
Examples of Infrastructure Interdependencies

Hospitals
Critical Infrastructures

- Energy (electric power, oil, natural gas)
- Telecommunications
- Water Systems
- Banking and Finance
- Emergency Services
- Hospitals
- Government Services
- Agriculture
- Others
Illustrative Infrastructure Dependencies for Electric Power
Examples of Interdependencies
Effects in California

Factors That Could Contribute to an Energy Crisis

• Deregulation policies
• New energy marketplace dynamics
• Tight, high-cost gas supplies
• Utility financial crisis
• Substantial load growth
• Lack of new generating and transmission capacity
• Aging fleet of power plants
• Low hydro conditions
• Transmission/environmental constraints

1st Order Effects
- Gas Supply
  - Curtailed Natural Gas Production
- Co-Generation
  - Reduced Steam Production for Heavy Oil Production

2nd Order Effects
- Oil Pipeline
  - Disruption of Product Pipelines
- Refineries
  - Inventory Buildup; Curtailed Operations
- Storage Terminals
  - Inventory Draw Down; Shortage of Gasoline and Jet Fuel

3rd Order Effects
- Water
  - Disruption of Irrigation Pumps
- Agriculture
  - Crop Losses
- Oil Production
  - Reduced Heavy Oil Production
- Road Transportation
  - Shortages of Specially Formulated Gasoline
- Air Transportation
  - Disruption of Flight Schedules
- Banking and Finance
  - Financial Losses

Diagram:

- Electric Power
- Oil Pipeline
- Gas Supply
- Co-Generation
- Refineries
- Storage Terminals
- Water
- Agriculture
- Oil Production
- Road Transportation
- Air Transportation
- Banking and Finance

Flow:

- Power Disruption
- Supply & Demand Imbalance
- Reduced Gas Supply
- Curtailed Natural Gas Production
- Disruption of Product Pipelines
- Inventory Draw Down; Shortage of Gasoline and Jet Fuel
- Disruption of Flight Schedules
- Financial Losses
Illustrative Infrastructure Dependencies for Water

- Road
  - Transport to Operations Center
  - Component Shipping
  - Water Resupply
  - Repair Crew to Sites

- Water
  - Oil
    - Backup Generation Fuel
    - Lubricants
    - Component Shipping
  - Rail
    - Control Systems
  - Telecom
    - SCADA
    - UPS
    - Lift Stations
    - Pump Stations
  - Electric
    - Operation & Repair Crew Communication
    - Transfer Operations
Telecommunications Disasters and Disruptions

People

Equipment

Natural

Software

Environment

Hardware
From the radio base station, the call is routed via microwave or wire (overhead or buried) through the Public Switch Network (PSN) which provides dial tone service and access to non-cellular phones and long-distance service.

The Operations Center is the location of the operational and administrative functions of the company.

The covered area of a cellular network is divided into small areas called cells. Each cell has a Radio Base Station which communicates simultaneously with all mobiles within the cell via a radio interface. Each radio base station has an antenna to facilitate receiving and sending radio signals. (A base station may also be known as a cell site).

To the end user, the main part of the equipment is the Mobile Station (end user device: handset/radio unit which may be a phone or other device) located in a vehicle (1A) or in a residence or business (1B). Answering equipment or data terminals may be added to the basic unit.

Traffic is then passed via microwave or wire (overhead or buried) to the mobile Switching Center (MSC). The MSC controls a number of cells (or cluster), arranges base stations and channels for the mobiles, and handles connections. (Also known as traffic Switch Center or Mobile Telephone Switching Office).

A cellular network consists of mobile units linked via a radio network to an infrastructure of switching equipment interconnecting the different parts of the system and allowing access to the fixed Public Switch Network (PSN).
Gas Interdependencies During Emergencies

• **System Dependencies**
  • Dependent on Gas System
    • Electric generator
    • **Hospitals**
    • Life safety agencies using natural gas for their emergency generators
    • Others – Public health and welfare
  • Gas System dependencies
    • Electric utilities
    • Telecommunication utilities
    • Water Utilities

• **Coordination Dependencies**
  • Electric Utilities – leak surveys prior to electric restoration
  • Public Agencies
    • Site access
    • Resources
    • Status information
Pipeline Infrastructure

• Important Life Line For Society
• Petroleum Industry Supplies Energy In A Continuous Manner From Wellhead To Your Car
• Oil Well – Tank – Pipeline – Refinery – Pipeline – Distribution Terminal – Truck to Service Station
• Continuous Flow: Interruption Of A Few Days Can Have Major Impact on Public
• Examples:
  • Pipeline Down Times Of A Few Days Have Resulted In Spot Shortages In Delivery Markets Such As Reno, Las Vegas, Phoenix, etc.
Examples of Cascading and Escalating Interdependencies
Threat Matrix For Utilities

- High-consequence
  - Severe Earthquake
  - Rare Flood
  - Bioterrorism
  - Severe Sustained Drought
  - Serious Attack on Facilities

- Low-consequence
  - Mild Earthquake
  - Small Flood
  - Vandalism
  - Breaks
  - Power Failure

- High-probability
  - Experience Base

- Low-probability
  - Experience Base
The following disasters come with some notice.
St. John’s Regional Hospital, Joplin, Missouri
The following disasters come with *no* notice
What does more damage than all of the previously mentioned disasters?
September 8, 2011
Southern CA Power Outage

- Outage began 3:38pm and was restored by 3:25am
- 1.4 million electric meters and 850,000 gas meters out
  = 3.5 million people out of power in Southern California
- 1.1 million electric meters out in Mexico
- Largest power outage in California History
- Extreme traffic issues on I-5 and I-15
- $12-$18 million food losses at restaurants and grocery stores
- Sewage plants spilled 2 million gallons of sewage into beaches
- San Diego Airport cancelled all outgoing flights
19 Hospitals in Outage Area
2 with Generator Problems

Scripps Mercy Hospital
• Malfunctioning circuit board cut power to sole generator
• Battery packs and flashlights used
• Totally out of power for 2 hours

Sharp Memorial Hospital
• 1 generator failed and 3 could not produce full power
• Lights dimmed and extra staff
• Problem lasted 3 hours

All Hospitals were Extra Busy in the Outage Zone:
• More Heat-related illnesses
• Refrigeration of vaccines from small clinics
• People came to plug-in portable oxygen machines
• Patients transferred from nursing homes and military bases
It’s not that we cannot solve the problem, sometimes we cannot even see the problem
When you are in deep trouble say nothing, and try not to look inconspicuous.
A small body of determined spirits fired by an unquenchable faith in their mission can alter the course of history.

Mohandas Gandhi
Questions???
Thank you for your interest!

Don Boland
Executive Director
California Utilities Emergency Association
916-845-8518
www.cueainc.com