Edwin Lee, Mayor
Amy Brown, Acting City Administr

City and County of SAN FRANCISCO LIFELINES COUNCIL

Thursday, August 11, 2011
2:00 PM – 4:00 PM
Pacific Gas & Electric, 77 Beale Street

Lifelines are the systems and facilities that provide services vital to the function of an industrialized society and important to the emergency response and recovery after a natural disaster. These systems and facilities include communication, electric power, liquid fuel, natural gas, transportation (airports, highways, ports, rail and transit), water, and wastewater.
- American Society of Civil Engineering Technical Council on Lifeline Earthquake Engineering (TCLEE), 2009

CO-CHAIRS

Amy Brown
City and County of San Francisco
Acting City Administrator
General Services Agency

Chris Poland
Chair, NEHRP ACEHR
Co-Chair, SPUR Resilient Cities Initiative
Chairman, Degenkolb Engineers

REPRESENTED AGENCIES

AT&T
BARCfirst/BRMA
Bay Area Center for Regional Disaster Resilience
CalTrans
CAPSS
Comcast
Degenkolb Engineers
G&E Engineering
Laurie Johnson Consulting
Metropolitan Transportation Commission
NERT
Office of the City Administrator
PG&E
Port of San Francisco
San Francisco Capital Planning
San Francisco Department of Emergency Management
San Francisco Department of Public Works
San Francisco Department of Technology
San Francisco General Services Agency
San Francisco Human Services Agency
San Francisco Municipal Transportation Authority
San Francisco Public Utilities Commission
SPUR
Verizon Wireless

MEETING #6 NOTES

1) Welcome and Introductions — Amy Brown and Chris Poland, Co-Chairs

Opening remarks by Lifelines Council Co-Chairs, Amy Brown and Chris Poland.

2) Great East Japan Earthquake and Tsunami – Lifeline Performance and Interdependency (Presentation) — John Eidiginer, G&E Engineering Systems & TCLEE Investigation Team Leader

John Eidinger provided an overview of his visit to Japan following the Tohoku earthquake and tsunami. Mr. Eidinger observed the importance of building stronger buildings for the resiliency of the larger community, as opposed to building to minimum code standards.

He noted that about 80% of the damage sustained by the region was caused by the tsunami that followed the earthquake. Mr. Eidinger showed a video of the physical damage to illustrate the impact. The footage primarily presented how sudden and destructive the tsunami occurrence was on roads and buildings.

<u>Sewage</u>
The tsunami destroyed nearly all the sewage system and treatment facilities along the Tohoku

coast. The water level and velocity at which the tsunami hit these facilities far surpassed what most plants were designed to withstand. Mr. Eidinger emphasized that San Francisco's lifelines must prepare for a catastrophic-level disaster, and not focus solely on a probabilistic design basis. Rebuilding the wastewater treatment facilities has become a major issue for local community restoration. The cost of maintenance before the event would have been significantly less than the current cost that Japan faces in the rebuilding phase. The pumps that were destroyed by saltwater impact during the tsunami are now being rebuilt using stainless steel. Tanks were elevated to reduce the tsunami effects, but some were still impacted the water and did not float as well as designed.

Liquefaction

Liquefaction was particularly problematic in Tokyo especially in landfill sites in and around Tokyo Bay (observation on Disneyland site). Cisterns, which were installed to supply fire-fighting and potable water capacity for the local community following the event, were not useful in these liquefaction zones because they did not hold up to the impact. This is a lesson for San Francisco's cistern usage.

Fires

As in Christchurch, fires contributed to a large portion of the damage in Japan. These effects are important to consider as a potential aftermath in San Francisco. The seismically designed pipelines in Chiba Prefecture helped to minimize damage; elsewhere where these were not used, much more damage resulted.

Power

Mr. Eidinger took particular interest in what happened to electronic bushings. In future analysis, he hopes to identify why they have been breaking and how to design them better. He noted that emergency generators worked perfectly, where available, with the exception of wastewater treatment facilities.

Comments and Questions:

What is considered a successful level of recovery for the power suppliers?

The power suppliers are successful when customers get power. For the most part, Japan has been successful in doing so following the Tohoku disaster, although not completely without restriction—air conditioning is restricted in eastern half of Honshu because there is insufficient supply to meet the peak demand in Japan's hot summer months. This is a significant lifestyle change for many, but a culture of citizen cooperation is contributing to Japan's successful energy recovery.

Given the space limitations of San Francisco, how can we facilitate generators in areas as in Sendai in addition to providing enough space for other necessary makeshift infrastructure after an event?

The Sendai area is even more compact than San Francisco, and the generators are quite small, so space is not a critical issue. It is important to keep in mind that most of Sendai was virtually unscathed—only the areas in the tsunami zone were destroyed. We need to look closely at Sendai and the lessons we can glean from their good building and infrastructure performance outside the tsunami-impact zone.

3) Launching the Lifelines Interdependency Analysis (Presentation and Working Session)

Laurie Johnson, Ph.D., AICP, Principal, Laurie Johnson Consulting | Research

Lifelines Council Objectives

One of the primary objectives of the Lifelines Council is to more fully understand the interrelation of the represented organizations in restoring their individual systems as well as helping the recovery of the economy, housing, and quality of life in the city and region, following a disaster. The lifelines interdependency analysis aims to identify the choke points in recovery and restoration, in order to go beyond having each operator look only at their specific system and, instead, to collaboratively figure out the specific dependencies and interdependencies among the systems. There are distinctions to be made between upstream (those that an agency depends on) and downstream (those that depend on that agency) dependencies and it is critical to identify and understand them.

Defining the Interdependency Study Approach

Since the Council's April 2011 meeting, we have continued to research other examples and approaches to conducting interdependency studies. Several studies, such as those led by Chang et al. in Vancouver and Porter et al. in southern California, presented disaster scenarios to groups of lifelines operators and then asked them to qualitatively answer questions about the expected damage and restoration patterns for their system, identify dependencies on other systems as part of those restoration assumptions, and also identify their mitigation priorities. After the April meeting of the Lifelines Council, we assembled a small group of operators representing the key utility sectors here in San Francisco to discuss different study approaches and issues. We agreed to move ahead with an approach similar to the scenario studies led by Chang and Porter et al.

As a next step, we have prepared a discussion guide and members of the Council are asked to join one of four breakout groups to discuss various issues related to scoping the interdependency study and approach:

- Group 1. Interdependency Study Scenario Selection
- Group 2. Interdependency Study Analysis Questions
- Group 3. Interdependency Study Goals and Outcomes
- Group 4. Community Expectations for Lifeline Performance

Breakout Session Summary Report

Group 1. Interdependency Study Scenario Selection

Facilitator: Mary Ellen Carroll

Participants: Lifeline Council emergency planners and operations staff

The proposed interdependency study approach will utilize an earthquake scenario(s) to assess lifeline system impacts and consequences, and to consider upstream and downstream dependencies on other lifelines system. This group's charge is to help specify the scenario(s) to be used in the study. Regional catastrophe planning efforts, such as the Urban Area Safety Initiative (UASI) studies, typically use scenarios depicting maximum credible events. Mitigation planning, on the other hand, more often looks at the likely, or expected, events to occur in the usable life of structures or infrastructure. Another issue to consider is the geographical extent of the scenario since many lifeline systems extend beyond the city limits and system restoration will be a regional issue. It has also

been suggested that an 'accepted' scenario be used for this analysis, rather than one that is no well-known or commonly used.

1.1. What scenario(s) (fault/magnitude/intensity/duration and geographic extent) should the interdependency study use? Please review the following options (with examples attached) and rank preferences, nominate additional scenarios for consideration (if not listed), and provide reasons for your preferences.

The interdependency study scenario breakout group compared several scenario options based on studies commonly used in current planning efforts and recommended using data from the EERI/Kircher et al, 2006 study with a M7.9 San Andreas (MCE) earthquake. This scenario and data available provide the best comprehensive snapshot of 19 North California counties, many of which are linked by lifelines and common operators, allowing for both a regional and a local perspective. They recommended supplementing this study's data with CAPSS data for San Francisco, when necessary, but chose to recommend against using CAPSS data independently because it is too limiting in geographic scope. The scenario group also recommended expanding the scenario narrative to explain how this study's data lines up with the CalEMA Coastal Region, which overlaps with the Kircher study in 14 counties.

1.2 Besides details on ground shaking, what additional information should be provided in order for agencies to qualitatively describe: 1) damage, impacts, and consequences to their systems and facilities; 2) restoration (as a percent of normal functioning) over time (i.e. 4 hours, 1 day, 2 days, 3 days, 1 week, 2 weeks, 3 weeks, 1 month, 2 months, 6 months, etc.); and 3) identify both upstream and downstream dependency assumptions about other lifeline systems for restoration.

The scenario group recommended including the following elements in the Interdependency Study scenario: GIS files of ground shaking with administrative boundaries, building damage totals by administrative unit, fire district boundaries, PUC and PGE&E pipeline data where available, a map of the city's priority routes for clearance, and a scenario narrative with prescribed consequences similar to an exercise scenario

1.3. Should any scenario and/or data modifications be made to address special study areas, such as liquefaction zones, landslides, fire-following damages, hazardous materials?

The scenario group recommended modifying the scenario in the Kircher study to supplement liquefaction data with data on lateral spreading, data on dams in and out of San Francisco, and data on mutual aid availability for relevant agencies.

1.4. What other considerations and/or constraints are relative to scenario aspects of the study? These might include proprietary data, security issues, personnel for study, timeline for study.

The group identified proprietary data and security issues as the key constraint for the study.

Group 2. Interdependency Study Analysis Questions

Facilitator: Cynthia Chono

Participants: Lifeline Council operations and emergency planner staff

The proposed interdependency study approach will utilize an earthquake scenario(s) to assess lifeline system impacts and consequences, and to consider upstream and downstream dependencies on other lifelines system. This

group's charge is to help specify the kinds of questions and information to be provided by agencies and operators to sufficiently understand system interdependencies.

2.1 Given an earthquake scenario with estimated ground shaking intensity and duration, at what geographic resolution and over what timeframes can the following information on lifeline system impacts and restorations be developed?

The Interdependency Study Analysis group noted that because lifeline systems have vastly different capabilities and don't mirror geographic areas, they will inherently have an uneven ability and necessity to restore different systems by specific district. They also reinforced the value of including percentage of service restoration by time period in lifeline performance and design standards.

2.2 Please indicate the extent to which the following questions could, or should, NOT be addressed as part of the interdependency study analysis to identify both upstream and downstream dependency assumptions about other lifeline systems for restoration?

The group offered that most of the questions proposed by the guide could and should eventually be addressed. At this time, it may not be necessary to know or understand the details of how each facility owner will conduct damage assessments or where the city of San Francisco falls in their priority list. They also advocated for asking more specific/direct questions that indicate the scope of the answer. The group suggested framing the questions using a timeline or suggested variables:

> *Ex: After an earthquake of given intensity, what percent of services to San Francisco would be restored in 4 hours, 1 day, 3 days, and 7 days?*
> *Ex: What factors, information, and resources will you need to expedite the restoration of services to San Francisco (employee transportation; logistical employee support; other lifelines such as a electricity, gas, and communication; availability of lifeline structures such as pipes, wires, asphalt)?* And an example answer would offer information such as: *Agency first needs to repair pipeline in Oakland.*

2.3 What agencies, operators, and additional sectors should be included in the study?

The group suggested adding BART, fiber-optic networks, and radio station operators to the list of lifeline operators to be part of the study. Additional stakeholders to consider – also suggested by the Goals and Outcomes group – are retail businesses and the military. This group would like to see a clearer definition of *lifelines* in the context of recovery in order to adequately address the goal of expedited restoration, because some data suggests that it may be a better strategy to expedite the restoration of basic retail business (e.g. restaurants, grocery, hardware stores) instead of developing major distribution points for food, water, etc.

2.4 Is there a sequence or order in which the agency/operator or sector analysis should be performed? If so, please rank the top 5 agencies/operators or sectors that are likely to be the most "upstream," such that other systems are more likely to depend upon them and their restoration delays would have the most likely cascading effects?

The group recommended that an initial survey needs to be completed to identify participants before they can be ranked into a sequence.

2.5 How should the analysis be conducted, considering both time efficiency and effectiveness of data gathering and results?

The group recommended that an agency participating in the analysis should have a single point of contact for questions. The answer to a list of questions may require the involvement of numerous individuals, but the facilitation of information gathering should be done by a single individual who will report to the Lifelines Council.

2.6 What other considerations and/or constraints are relative to interdependency analysis aspects of the study and how they can be addressed? These might include proprietary data, security issues, time necessary to complete the work, and personnel necessary for the study.

Liability issues were indentified as a major concern for study participants, so the group suggested including prompts in the survey to address what is discoverable (subject to Sunshine or public disclosure), and what is confidential, as well as how to secure this information. This is especially important if industry competitors participate in a publicly conducted and financed study.

The group also recommended keeping in mind State and Federal priorities for lifeline restoration, and engaging with appropriate representatives to keep our government partners apprised of our local efforts and results.

Group 3. Interdependency Study Goals and Outcomes
Facilitators: Amy Brown and Chris Poland
Participants: Lifeline Council management and operations executives

Utilizing the Lifeline Council's objectives as a guide, the charge of this group is asked to identify the top goals and desired outcomes for the interdependency study.

3.1. Identify the priority goals for the Interdependency Study. The following options are provided, with room for additional options to be added. To the extent possible, please rank and also identify if these are near-term (1 to 2 years) or longer-term goals (>2 years).

The group first decided to change the definition of "near-term" from *1-2 years* to *2-5 years*, and "longer-term" from *>2 years* to *>5 years* to realistically reflect the Lifelines Council's capabilities to complete the work.

The group then ranked the ***near-term*** goals in the order of priority (1-4):

1. To build a workable understanding of system interdependencies and consequences to help expedite response and restoration planning among agencies.
2. To identify key assets and restoration priorities/schemes to prioritize post-disaster restoration and reconstruction activities for the city, and ultimately the region.
3. To identify consequences of existing conditions.
4. To develop a collective set of lifelines performance expectation under current conditions.

The group identified the following goals as long-term:

1. To extend the city's and lifeline operators' preparedness capabilities for the response, restoration, and recovery periods post-disaster (for operators where extending capabilities will take more than 5 years).
2. To aid in personnel training and cross-training of risk management expertise across sectors (they identified this goal as a continuous effort, extending indefinitely).
3. To involve businesses, non-profits, and military partners.

3.2. Identify the desired outcomes for the Interdependency Study that would strengthen the overall objectives of the Lifelines Council and the priority goals just identified for the Interdependency Study. To help stimulate discussion, the following options are provided with room for additional options to be added.

The goals and outcomes group identified all of the following as desired outcomes for the Interdependency Study:

- Development of an integrated infrastructure and key asset geospatial database(s)
- Develop information sharing procedures and protocols both for preparedness and response/coordination
- Development of a more detailed and comprehensive scenario of lifeline system impacts and restoration assumptions, for agencies to use in emergency response planning, table-top exercises
- Development of a economic loss model that reflects lifeline system impacts and restoration assumptions
- Identify key critical nodes and chokepoints in system interdependencies for continued work on inter-agency coordination and reducing lifeline interdependencies between sectors and systems
- Identify priorities for public funding (e.g. city bonds, infrastructure financing districts) necessary to underwrite or encourage correcting choke points that affect multiple systems
- Identify priorities for legislative and regulatory changes, and barriers that need to be overcoming for utilities to improve lifeline post-disaster performance and restoration
- To identify priority routes and access points required to work on system restoration and recovery
- Obtain credentialing for personnel to work on system restoration and recovery
- Launch a regional lifelines interdependency study
- Publish updated expectations so business and community partners know results of gap analysis and understand how their dependencies will be affected.

Group 4. Community Expectations for Lifeline Performance
Facilitators: Kay Vasilyeva and Lucas Eckroad
Participants: Community participants

This group's charge is to provide inputs into the study on the public's awareness, needs, and concerns about lifeline system performance and interdependencies.

4.1. What do you know, or have been told, about what to expect regarding lifeline system impacts and restoration following a major citywide disaster? Where did this information come from?

The group agreed that the general public has a misconception about the impact of major disasters on lifelines because their most relevant benchmark for post-disaster restoration is the 1989 Loma Prieta earthquake, commonly mischaracterized by the public as "the big one." Some mistakenly anticipate that damage from a major earthquake will be similar to that sustained in '89, and don't recognize other earthquakes closer to San Francisco, on the San Andreas or Hayward faults, can be much larger. The general public also expects that lessons have been learned from Loma Prieta, and measures to address performance gaps have already been sufficiently implemented. There is a clear disconnect between community perception of how prepared and resilient the city is at its current state, and what is actually the case.

The general public is also less likely to anticipate widespread damage to transportation infrastructure, including roads and public transportation, and expect that they will be able to leave the city easily if services are not quickly restored. Some assume that ferry service will be dedicated to San Francisco and lack a regional perspective.

Today's involved citizens also rely on various technology platforms for immediate information delivery, including forms of social media, and will anticipate that the city will be able to provide updates using those outlets. Many do not have a contingency plan for acquiring information if the internet or cell service is unavailable.

4.2. What preparedness efforts and contingency plans does your family, employer, or neighborhood have to specifically address expected lifeline system impacts following a major citywide disaster?

Most in the private sector and business community don't have adequate contingency plans, and the public in general is insufficiently prepared due to a lack of understanding about what lifelines are truly critical (e.g. electricity vs. water and sewage). Employers in the small- to medium-sized business communities are woefully unprepared to deal with the operational and economic consequences of a disaster and need better education to motivate their contingency planning efforts. Individuals' and families' existing plans generally don't adequately address water and sanitation needs. The public can benefit from truthful education about the government's capability and responsibility after a disaster in order to have reasonable expectations and understand their personal responsibility for preparedness.

4.3. Utilizing the Lifeline Council's objectives as a guide, what are your recommended goals and desired outcomes for the interdependency study?

The group recommends enhancing a culture of citizen preparedness throughout the city by providing educational opportunities, improving messaging, and improving the integration of NERT training into community resilience initiatives. Currently, NERT is largely oriented to training, and emergency supply caches for teams are determined by the individual teams. Better supplies that also recognize likely lifeline disruptions could boost the capability of NERT and enhance community preparedness.

5) Adjourn

Meetings will continue on a quarterly basis. The next meeting is targeted for November 17, 2011 and will report on next steps in the interdependency analysis.