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Workshop on Interdependent Lifelines, Risk, and Regional Resilience: South Napa Earthquake Lessons Learned and Priority Actions for the "Big One"

Held February 20, 2015 at the Alameda County Office of Emergency Services, Dublin CA

Summary of Outcomes

Representatives from local government, private sector, and non-profit organizations from across the Bay Area met with state and federal partners to examine lifelines response and initial recovery after the M6.0 South Napa earthquake on August 14, 2014. A key goal of the workshop was how to better assess risk and assure the resilience of Bay Area interdependent lifelines—water and wastewater, energy, communications, and transportation—in a major earthquake or other regional event. The workshop resulted in a large number of findings on "what worked and what didn't" for restoring lifelines in the days after the quake, with nine potential actions to improve Bay Area resilience for "the big one."

Workshop Objectives, Focus, and Format

The objectives, focus, format and agenda were developed by a small Planning Group that included representatives from the City of Napa and regional lifelines.[1] Key issues (objectives) selected for attention included the need for, and activities underway to:

- Improve assessment capabilities to determine damage to, and disruption of, interdependent lifelines services.
- Better coordinate and prioritize allocation of scarce resources post-event, including repair crews, fuel, equipment, components, and materials—to rapidly restore interdependent lifelines that are essential for community and regional resilience.
- Gain a good understanding of processes and requirements for mutual aid and other assistance, including reimbursement for restoration activities post-disaster.

The agenda was comprised of three panels of lifelines and government representatives and designed to highlight these issues and point to useful actions. Panel 1 focused on lessons learned associated with lifelines restoration from the South Napa Earthquake, Panel 2 on assessment capabilities to identify potential risks from major earthquakes to interdependent lifelines, and Panel 3 on post-event resource coordination, allocation, and reimbursement. There were two short informative presentations on regional earthquake planning activities during the working lunch, the first on the development of the updated Regional Earthquake Plan for the Bay Area led by the California Office of Emergency Services with FEMA Region IX, and the second by

[1] San Jose Water Company, East Bay Municipal Utility District, Alameda County Water District, PG&E, City of Napa, Verizon Wireless, Caltrans–District 4, Santa Clara Valley Water District, U.S. Environmental Protection Agency Region IX, U.S. Department of Energy Region IX, and the Bay Area Center for Regional Disaster Resilience

the Bay Area Urban Areas Security Initiative (UASI) on infrastructure interdependencies and supply chains and logistics.

Highlights of Workshop Proceedings
(please refer to presentations provided through DropBox for additional details)

Introductory Overview

Paula Scalingi, Executive Director, Bay Area Center for Regional Disaster Resilience, pointed out that while the South Napa earthquake was a manageable event, it raised concerns about the need to focus on high-priority preparedness and resilience challenges facing the region's interdependent lifelines, which would be magnified many times over in a major earthquake or other catastrophic event. These priority challenges include a better understanding of damages to physical and cyber assets and systems and resulting health, economic, environmental, and security consequences. Another is multi-jurisdiction and cross-sector coordination of allocation of scarce resources for post-disaster restoration (repair crews, fuel, equipment, components, materials, and technical and medical staff). Dr. Scalingi noted that there are plans, policies, or requirements that could constrain timely restoration of disrupted lifelines, or, if not followed, complicate or deny reimbursement for mutual aid and other assistance. She cited the importance of an interdependencies-based regional risk assessment process to promote and assist in investment decision-making at the organizational, community, and state levels. Such an approach is also needed to validate, and win public support for pre-event mitigation and post-disaster restoration actions. These actions could include hardening, replacing, relocating, siting, and/or building infrastructure; creating systems redundancy; and other "big ticket" projects.

Opening remarks

Brian Scully, Deputy Director for Policy, U.S. Department of Homeland Security Office of Infrastructure Protection (DHS/OIP), provided a national-level perspective on the importance of infrastructure and regional security and resilience. He said the updated National Infrastructure Protection Plan is heavily focused on these priorities and capacity building through stakeholder outreach, training, and exercises. He noted DHS OIP's sponsorship of pilot projects in Tampa, FL and Charleston, SC. OIP is interested in promoting public-private partnerships to further information sharing on threats, facilitate security and resilience decision-making, and to provide tools to help stakeholders make necessary improvements. The focus of DHS is on the full disaster lifecycle—protection, prevention, preparedness, response, and recovery/restoration, including building in resilience post-disaster.

Panel/Participant Discussion 1: Lessons Learned from the South Napa Earthquake

Phil Brun, Deputy Director for Operations, Public Works, City of Napa, provided an instructive overview of damages and challenges that City officials faced with lifelines providers to move quickly to address earthquake damage to roadways, water systems, and buildings. He noted the M6.0 earthquake was the largest in the Bay Area since 1989, with the epicenter five miles south/southwest of the City, and caused 283 injuries in Napa County and one fatality. Fourteen County buildings were damaged, forcing relocation of more than 400 staff. Around 20,000 structures required damage assessment by certified building inspectors brought in from

outside the area. An issue was explaining to citizens what building damage assessment red and yellow tags meant. Posing an additional challenge was 7,400 tons of debris, with 187 tons of that electronic waste, much of it from flat screen televisions. Infrastructure damage of greatest concern was to water facilities. There were 240 leaks, with 120 in the first few days, but no damage to treatment plants, pump stations, or dams, and only one storage tank damaged. There was a "boil water advisory" issued. Key to the rapid restoration of water services was assistance through the California Water/Wastewater Agency Response Network (CalWARN), which offered to help within an hour after the earthquake. City officials provided logistics support for the CalWARN crews, including fuel, stockpiling backfill material, opening public water stations, and orchestrating food with restaurants unavailable, as well as housing and transportation of the CalWARN crews with other mutual support. A City and County "Napa Local Assistance Center" was opened, which was not closed until December 31. Among the key lessons learned from the response and initial recovery activities was understanding that "recovery work is 10 times harder than response," and requires having the ability to adapt to unforeseen and changing circumstances, more staff than anticipated, and for securing in advance of an event long-term commitments for mutual aid. Also essential are collaboration and reliance on relationships, and particularly communication. Debris collection sites should have been pre-determined and a centralized call center set up sooner with people manning the phones, not using answering machines, to handle service requests, rumor control, and volunteers. A centralized database should be created immediately to track inspections, with photos taken each time a damage tag is posted, with tags including "what to do now" information for property owners/residents. It is important to recognize that "when the big one comes" mutual aid or staff support will not be available. Beyond lifelines, other interdependent critical facilities and services will need to be taken into account, such as hospitals, county services and those of other agencies, public access to food and potable water, the jail, and the possibility that AT&T and other communications can be down, including the 911 system. Lastly, consideration should be given to FEMA and OES disaster reimbursement requirements from the beginning of the response, with understanding that "lots of documentation", including photos of damages and repairs—is necessary. This will require significant investment of staff time, familiarity with, and diligent following of FEMA rules to enable payment through Cal OES and be prepared for a potential audit.

Steve Dennis, Emergency Services, Hazardous Materials, and Security Program Manager, Alameda County Water District, for CalWARN (California Water/Wastewater Agency Response Network), provided an overview of CalWARN and key lessons learned from an effective deployment of mutual assistance to restore damaged water systems. CalWARN is comprised of water and wastewater agencies throughout the state that have signed an agreement to share emergency resources following disasters. The California WARN was the first of what are today 49 WARNs, in all but one of the 50 U.S. states. CalWARN works by facilitating contractual relationships pre-disaster, providing indemnification and worker's compensation, enabling a single agreement for statewide sharing of resources, and access to mutual assistance to improve response and expedite recovery. CalWARN also meets DHS and FEMA requirements for reimbursement consideration. CalWARN reached out to the City of Napa to offer assistance a little over an hour after the quake struck, signed an agreement with the City, and by the evening had five mutual assistance crews ready for deployment to Napa early the next morning. 120 water main repairs were made in five days with four CalWARN Mutual Assistance utilities participating. All customer services were restored by Aug. 29. Although a success for CalWARN and the City of Napa, which provided excellent logistical support for

WARN crews, the earthquake was a learning event. Key lessons learned included that it took 45 minutes for details on the earthquake to be reported on the USGS website, the importance of building and leveraging networks that can provide mutual assistance and other locally available resources, and that CalWARN (and other local mutual assistance agreements) operate outside of the Cal OES mission tasking process, making coordination and communication with OES essential. For local government reimbursement, the importance of comprehensive recordkeeping, including photos of damages and restoration actions, cannot be overstated. The CalWARN website – www.calwarn.org, has information on joining, a resource database, an overview of the CalWARN organization and its operational plan and how it is activated, and on coordination procedures, along with checklists and forms.

John Eidinger, G&E Engineering, provided a summary of the findings from the American Society of Civil Engineers Technical Council Lifeline Earthquake Engineering Report on the South Napa Earthquake. He observed that there was a need for improved understanding of earthquake risks—what lifeline assets could physically break, and the consequences, including from interdependencies. Regarding electric power impacts, PG&E had completed seismic upgrades for most of the high voltage transmission between 2000 and 2012. Consequently, the transmission assets sustained no material damage. There were some power outages, but power distribution disruptions were limited in part because PG&E's distribution transformers are directly bolted to wood poles so they were less likely to fall or be damaged. Natural gas disruptions were also limited. PG&E responded to 8,000 service reports of gas odor and leaks, making safety checks and 926 pilot relights in Napa and 110 in Vallejo. PG&E replaced a gas pipe near Napa that crosses the fault as a mitigation measure. Damages to AT&T communications were also limited, with no real loss of service. There were several fires ignited by the earthquake, but due to lack of wind, these were manageable. If there had been a moderate wind, with the loss of water pressure because of damage to the water system, conflagrations in the City of Napa would have been likely. A key lesson learned from the quake is that damage to buried water (and wastewater and gas) pipes is the big concern, and that installation of seismic-resistant pipes is required to address major earthquakes. This process would take 10-30 years and require an extensive and long-term investment. The alternative to not acting is post-event long outages with economic consequences, loss of water for firefighting, and contamination of waterways with raw sewage. Other potential actions are pre-determination of, and having capabilities for rapid set up of base camps for lifelines utilities response and restoration, and pre-identification of materials and storage sites for necessary resources, including pre-event purchasing and stockpiling.

Panel/Participant Discussion 2: Status of Assessment Capabilities to Identify Potential Risks from Earthquakes to Interdependent Lifelines

Cecile Pinto, Manager ICS and Emergency Management, and Michael Velasquez, Manager, Partnerships and Outreach, Emergency Preparedness and Response for PG&E, spoke on PG&E's response priorities and capabilities, highlighting lessons learned from the South Napa earthquake and activities underway to better assess damages and improve resilience. Priorities include protecting the health and welfare and property of the public, PG&E responders, and others; restoring gas and electric service and power generation, and critical business functions; informing customers, governmental agencies and representatives, the news media, and other constituencies; and initiating operational plans and a work plan. Capabilities include a crew of

gas technicians, Rapid Assessment Teams, and staff with assigned emergency roles and on 911 standby. A key element of the PG&E response and initial recovery is establishing Base Camps with logistics support and agreements signed in advance with site property owners and with vendors for rapid set up. A lesson learned from the Napa quake was the importance of Base Camp communications, which PG&E has rectified. PG&E has an Earthquake Playbook and Catastrophic Incident Response Plan, tools to predict and manage power outages and detect and analyze gas leaks, and utilizes USGS earthquake shake maps for exercises and planning and for asset damage modeling. PG&E damage assessment capabilities are evolving. The focus is on assessing consequences from natural hazards to prioritize overall damage and risk to electric power assets and resources required for service restoration. Gas system damage assessment modeling is less advanced, but there are plans to develop upgraded capabilities. Regarding regional energy infrastructure dependencies with other lifelines service providers, PG&E will begin meeting with EBMUD to better understand power/water systems interdependencies and potential impacts, and has participated in the San Francisco Lifelines Council interdependencies study and other activities. PG&E has mutual assistance agreements established to access and coordinate post-event resource acquisition. An important focus of PG&E preparedness and resilience activities are coordination with Bay Area local governments to ascertain county and critical customer priorities and assets, and discuss access routes and other response/initial restoration requirements. PG&E also holds exercises with local, state, and federal agencies, the Red Cross, and other key stakeholders.

Serge Terentieff, Manager of Design Division; Roberts McMullin, Associate Civil Engineer Pipeline Infrastructure; and Yogesh Prashar, Associate Civil Engineer Materials Engineering for EBMUD, provided an overview of EBMUD's interdependencies between its water system and power, its damage assessment capabilities, and next steps to improve its resiliency and emergency response capabilities following a major earthquake. Key focus areas include increasing public awareness, better understanding of interdependencies with other lifelines (power, transportation, fuel, communications), and setting reasonable expectations for return to service based on potential impacts, service outages, and restoration timeframes. The EBMUD system includes 29 dams, five water treatment plants, 138 pumping plants, 167 reservoirs and tanks, 122 pressure zones, and 4,200 miles of distribution pipe including 360 miles of large diameter pipes. EBMUD developed its own internal software, called Marconi, to better plan, respond, and recover from various types of emergencies and hazards. This Marconi software tool incorporates the use of ShakeCast to provide a rapid damage modeling capabilities, using pre-determined inputs including fragility curves and various hazard exposures such as liquefaction and landslides to compute damage and risk under different earthquake scenario events to estimate potential damage to EBMUD facilities, such as embankment dams, tank reservoirs, pumping plants, and large diameter pipelines. For a Hayward M7.0 earthquake, EBMUD estimates the pipeline leak repairs would be in the thousands for its water transmission and distribution system. Depending on the magnitude and location of the earthquake, a significant number of EBMUD's pump stations would also likely lose power and it would likely take several days or longer for PG&E to restore power. Priority locations have been identified for immediate pumping using portable pumps and emergency generators, but EBMUD only has a limited number of emergency backup generators and portable pumps available. Fuel availability is also likely to be a major issue, depending on the duration of power outages. Water treatment plants and pumping plants at priority locations would have on the order of 24 to 48 hours of fuel for backup pumps and generators, which EBMUD tests and exercises regularly. EBMUD also

has inter-agency cooperation and agreements to secure necessary resources with CalWARN, the Los Angeles Department of Water and Power, and the Las Vegas Valley Water District. EBMUD in addition has emergency interties with other water systems, is working on developing a plan for emergency drinking water procurement and distribution, and a post-earthquake pipe repair mitigation plan. EBMUD participates in the San Francisco Lifelines Council Regional Coordination Work Group and is involved in many other regional coordination activities. An important new focus is discussions with PG&E and other private and public entities on lifeline interdependencies, overlaying damage prediction scenarios and comparing priorities for restoring service and continuing work with cities and counties to coordinate response and recovery plans pre-event. A key goal for EBMUD is to further develop their damage prediction modeling capabilities to enable quick predictions to help prioritize inspections, improve real-time response, and expedite service restoration after a major earthquake.

Bob Braga, Branch Chief, District Emergency Management, Caltrans, provided an overview of Caltrans District 4, the Caltrans response, and Caltrans's ShakeCast earthquake damage assessment system and current resilience improvement activities. Caltrans District 4 covers the nine Bay Area counties, encompassing over 6,500 miles of highways, 2,500 bridges, seven toll bridges, and several major tunnels. The Caltrans response to the South Napa quake began immediately after a USGS system monitor sounded an alert in the Caltrans Oakland Transportation Management Center. Caltrans field crews and California Highway Patrol units made visual inspections of state routes and the region's toll bridges the day of the quake. Caltrans engineers used data generated by their ShakeCast, the web-based system developed with the USGS to examine potential damages to state transportation assets, to determine if any of the region's bridges sustained damage. The Napa quake enabled a good test of the Caltrans ShakeCast utility. The system identified 87 bridges for inspection and determined finding any significant structural damage to bridges would be a low probability. Inspection of the 87 state bridges followed over the next few days, with nine showing minor damages, but still safe to use. To improve regional transportation resilience, Caltrans is currently reassessing the seismic hazard and engineering performance of state bridges based on knowledge gained from more recent earthquakes and advancements in retrofit technology. This process is about half-way through, with the goal of evaluating and establishing seismic performance. Caltrans is also adding state facilities for seismic performance evaluation and working in partnership with the business community to explore interdependencies to arrive at "best practices" to mitigate and/or address interdependencies.

Regional Lifelines Interdependencies Activity "Snapshots": Bay Area Earthquake Plan and Regional Lifelines and Supply Chains Restoration Planning

Mark Johnson, Earthquake and Tsunami Program Branch Chief, California Governor's Office of Emergency Services (Cal OES), gave a brief overview of the process to update the Bay Area Earthquake Plan now underway by Cal OES and FEMA Region IX with other state, federal, regional, and local stakeholders. The end goal of the Plan, which is anticipated to be completed by the fall of 2015, is to assure individuals in areas impacted by a major earthquake receive life-sustaining services with emphasis on water, food, sheltering, transportation, and reunification of families. The Plan will also be recovery-focused and provide a framework for how to bring essential resources to assist. The Plan is challenging because it must take into account the demographics of the region—more than 10 million people, 16 counties, over 100

cities, many tribal communities, an economy that has the highest per capita GDP and percentage of innovation-related jobs in the nation, and at the same time economically disadvantaged areas with high poverty. The scenario on which the Plan is based is a quake involving either the San Andreas or Hayward Faults. The Hayward is the most urbanized earthquake fault in the nation with 2.4 million people living along the fault line, homes and other buildings located directly on the fault and transportation corridors, water pipelines, and other lifelines assets either crossing it with significant consequences for supply chains. The Plan will lay out the organizational coordination structure and process from the Governor down to local levels with federal partners for response going into initial recovery. Focus will be on saving and sustaining human life and minimizing suffering, stabilization and restoration of critical infrastructure, opening critical transportation routes, mass care, fatality management, public health and medical services, and support for moving survivors, and providing sheltering, food, fuel, water, and other life-sustaining commodities.

Janell Myhre, Regional Program Manager, Bay Area Urban Areas Security Initiative (UASI), spoke on past regional work on catastrophic planning (seven operational plans based on a M7.9 earthquake) and in progress covering the 12-County Bay Area focusing on logistics and critical lifelines restoration (power, water/wastewater, and fuel), as well as the work ahead. Bay Area UASI activities are coordinated with the Cal OES/FEMA regional earthquake planning. These efforts include training and exercises, such as the annual Yellow Command exercise with Urban Shield, and involve federal, state, regional, local, private sector, and non-governmental partners. Logistics planning focuses on staging areas, points of distribution, a Logistics Center Plan, and a Train-the-Trainer CD. Restoration planning focuses on facilitating the repair or replacement of infrastructure for lifelines, including oil, gas, electricity, telecommunications, drinking water, wastewater, Rx drugs, and transportation services. Three workshops were held in October 2013 to explore restoration interdependencies and the ways these interdependencies affect the timeline for restoration of critical lifelines. Dependency issues identified included: road clearance priorities, key equipment or repair supplies availability, prioritization of generator resources, fuel supply availability, transportation priorities for bottled water, fuel supply availability for lifelines and the healthcare sector, having private sector and government relationships prior to an incident, and transportation and access priorities for private sector personnel. Future efforts will continue to build critical lifelines restoration capabilities to further explore and better define interdependencies, enhance GIS planning for timely situation awareness, engage additional fuel supply partners, and explore regulations and a waivers process to expedite recovery. This work will be accomplished through collaboration with the San Francisco Critical Lifelines Council Regional Coordination Work Group, FEMA Region IX, Southern California critical lifelines restoration work, and state/federal catastrophic earthquake planning activities.

Panel/Participant Discussion 3: Issues in Coordinating, Allocating, and Reimbursement for Post-Event Scarce Resources

Steven Frew, Manager of Security and Emergency Preparedness, Regulatory Compliance Office, East Bay Municipal Utility District, speaking for the California Utilities Emergency Association (CUEA), described the CUEA role in utilities support and integration with government in emergencies that will be essential in a major earthquake, and lessons learned for CUEA from the Napa quake. He described CUEA as a point-of-contact for critical infrastructure utilities and Cal OES and other government agencies pre- and post-event to facilitate

communications and cooperation between member utilities and public agencies, and with non-member utilities (where resources and priorities allow). This includes providing emergency response support for interdependent electric power and natural gas, fuel pipeline, telecommunications, gas, and water/wastewater utilities, and support for utility emergency planning, mitigation, training, exercises, and education. Together the utilities CUEA supports provide service to 32 million people in the state. Regarding the Napa quake, CUEA worked with the Cal OES to provide situational awareness on damages and disruptions to power and water systems assets, California Highway Patrol road access for utility responders, and information from Caltrans on road closures that affected deployment of utility repair crews. CUEA also worked with other state agencies and Napa law enforcement officials and with the American Red Cross on assuring utility services for temporary shelters, and providing assistance to PG&E, AT&T, and water agencies in concert with CalWARN. A key lesson reinforced was the importance of having pre-event relationships in place between utilities and first-responders.

Jim Wollbrinck, Security and Emergency Preparedness Specialist, San Jose Water Company (SJWC), spoke on challenges in coordinating, allocating, and reimbursement for post-event scarce resources. He emphasized the need to have available for water systems repair and restoration repair crews, fuel (including storage for fuel tanks), emergency power generators, materials (e.g., valves, pipe, and other components), chemicals for water treatment, and communications). A particular issue was assuring the access to, and availability of maintenance personnel and other key staff (e.g., to move generators) and local and out-of-area contractors and mutual aid, and the importance of CalWARN and the "sister" WARNs in adjacent states. SJWC has been addressing these issues internally and also externally with county and other local agencies, through collaborative activities with regional stakeholders, and through outreach to oil refineries, pipeline companies, fuel distributors, and the California Energy Commission. Of particular importance are working with other utilities to improve understanding of infrastructure interdependencies and related implications for recovery and coordination of restoration operations and mutual assistance in a major incident involving damage or disruptions to co-located and other interconnected systems and assets. SJWC has spearheaded development of CIKR BAESIC (Critical Infrastructure and Key Resources Bay Area Emergency and Security Information Collaborative) to assist with this effort. CIKR BAESIC is an extension of the Bay Area Emergency and Security Information Collaborative (BAESIC) regional coordination group, which was established by SJWC and several other major Bay Area water utilities several years ago as an informal mechanism to further regional cooperation on issues of mutual concern. SJWC is also looking to development of seismic warning capabilities to prevent injury to maintenance workers in an earthquake or from after-shocks during underground and other potentially hazardous construction or repair activities.

Mary Ellen Carroll, Emergency Planning Director, San Francisco Public Utilities Commission (***SFPUC),*** focused on post-disaster restoration actions that public utilities need to take to enable cost recovery for restoration. Cost recovery is an important priority for SFPUC, which, as a public agency of the City and County of San Francisco, provides water, wastewater, and also electric power services to the City and an additional 1.6 million customers within three San Francisco Bay Area counties. City facilities served by the SFPUC include Muni, San Francisco International Airport, and the Modesto and Turlock Irrigation districts, Treasure Island, and Yerba Buena Island. The SFPUC manages a complex water supply system consisting of reservoirs, tunnels, pipelines and treatment facilities, and is the third largest

municipal utility agency in California. Nearly one-third of its delivered water to 2.5 million customers is distributed within San Francisco, while the remaining two-thirds is sent from the Hetch Hetchy Regional Water System to Alameda, San Mateo, and Santa Clara counties. In addition to delivering water, the agency is also responsible for treating wastewater before discharging it into San Francisco Bay and the Pacific Ocean. For cost recovery post-disaster, the goal is to avoid loss of reimbursement dollars, expedite the reimbursement process, minimize exposure to non-recoverable costs, and maximize eligible costs. Planning and organization must be done ahead of the event. Carroll underscored the need to "assume there's no such thing as too much documentation." After the event occurs, cost recovery activities should begin immediately. These activities will necessitate a large number of staff and ongoing financial management, public assistance grants, contract management, and handling of insurance claims. Other necessary activities will include attending key meetings with stakeholders (local, state, and federal), acting as liaison with Cal OES and FEMA for City departments, assisting in initial damage assessments, and in developing and managing project worksheets and supporting documents. Cost recovery may take years in major events and ends only when reimbursements have been closed by the grantor.

David Cunningham, Operations Manager–Fairfield, Verizon, described what worked and didn't for Verizon and takeaways from the South Napa quake response. The Verizon Operations Manager for the region contacted employees to verify their status and determine if any of them needed help. They were instructed to check on their families and property first. Employees used text messaging to update the Operations Manager on their status and availability or used satellite phones when the network became congested due to the large increase in call volume. Damages to Verizon assets included one cell site off the air in downtown Napa, 12 sites without power, eight of the sites on generator power, and four sites on battery power. Recovery activities included creating a list of prioritized impacted sites, conducting damage assessments, providing generators to sites without power and hardware as needed, restoring services to disrupted assets, and sending technicians to Napa and Solano to support recovery. Verizon also assisted PG&E in addressing connectivity issues associated with the PG&E command center next to the Napa County Fairgrounds, deploying a Cell on Wheels (COW) to increase coverage and bandwidth capacity. Challenges included not having backup generators at some key sites, a critical site having limited battery backup due to weight and hazmat concerns, which resulted in loss of cell service for an hour-and-a half at a hospital, and data connectivity issues, particularly in the first 24 hours due to the large increase in communications traffic. What worked included having a responsive, centralized team, focusing on priority site issues, strong relationships with contractors and vendors, pre-event preparing through disaster recovery drills, having backup communication methods in place and spare components available, and investing in network hardening. Key lessons learned included the need for backup communication and keeping satellite phones and two-way radios charged, having vehicles prepared and emergency fuel, food, and water on hand, and bringing in additional resources on standby early post-event to enable deployment quickly for unanticipated problems.

Fred Wehrenberg, Chief, Regional Integration Branch, and Bruce Knabenshue, Supervisory Emergency Management Specialist, FEMA Region IX, provided an overview of the FEMA disaster reimbursement process and requirements. In order to be eligible for disaster assistance, the emergency must be a significant event and the request to FEMA must come through the state. Local officials should look outside their jurisdiction or service areas for scarce resources first

before requesting public assistance. FEMA priorities for assistance are on life-saving and life-sustaining activities and hazardous situations. There are four broad requirements for eligibility. Assistance and reimbursement are available only for public entities, special districts, and certain non-profits and must cover facilities or assets located in the disaster-declared area and in-use at the time of the disaster; address damages caused by the event (mitigation actions can be included); and the costs must be reasonable with vendors procured through competitive bidding. Mutual assistance also is reimbursable if it is provided through, and according to, provisions in an existing agreement. Further information on FEMA disaster reimbursement can be obtained via the Internet in FEMA Public Assistance Guide 352 at https://www.fema.gov/public-assistance-local-state-tribal-and-non-profit/public-assistance-guide. Guide 352 is one of several guides in the FEMA 9500 series (http://emilms.fema.gov/IS634/PA0101110text.htm) that describes disaster-related public assistance policies and guidance.

Workshop Outcomes

The following key issues and follow-up collaborative actions were raised or recommended by participants in discussions, feedback forms, and post-workshop follow-up communications. Participant's providing specific actions to address workshop objectives included utility representatives, city officials (including GIS and operational staff), special district representatives, state, federal (FEMA Region IX and Coast Guard), and private sector representatives.

Workshop Objective 1: Improving Earthquake Impact and Risk Assessment Capabilities for Interdependent Lifelines Restoration Planning and Decision-making

What's Working

- Regional lifelines that serve the Bay Area are upgrading their damage and risk assessment capabilities, enhancing supply chain resilience, and undertaking mitigation and other measures to improve earthquake preparedness and resilience.

- Larger utilities have a broad understanding and recognition of the importance of dependencies and interdependencies that could affect restoration priorities after a major earthquake or other significant event. These utilities are involved in various regional studies and planning activities with customers and stakeholders, including the San Francisco Lifelines Council and the Bay Area UASI interdependencies and logistics activities. Regional lifelines are also collaborating with Bay Area officials in counties and many cities on local government restoration priorities for critical facilities in their jurisdictions.
    - PG&E and EBMUD are beginning discussions on how to overlay and assess their respective, relevant assets to facilitate interdependencies impact assessments.
    - There are existing forums that utilities can use to examine among themselves, or with government officials, a path forward to assess interdependencies, regional risk priorities, and restoration decision-making. These forums include the CIKR BAESIC and the San Francisco Lifelines Council Regional Coordination Work Group, also regional workshops and exercises. FEMA Region IX is planning to set up a multi-state stakeholder group that

will include Bay Area lifelines representatives to develop planning and decision-making guidance for post-disaster restoration.

- Local GIS and state infrastructure protection officials are in the initial stages of looking at how to move forward to discuss and develop decision making products (guidelines and other tools) to support state and local top decision-makers on interdependent lifelines mitigation and restoration actions for major earthquakes and other catastrophic events.

What Still Needs to be Done

- Lifelines and local agencies that need to work together to prepare for, and restore essential services after a major earthquake have limited knowledge beyond first-level interdependencies of expected health and safety, economic, and environmental consequences and how deeper levels of interdependencies can delay and complicate service restoration.

- At the local and regional levels, there is a lack of interdependencies analysis and risk assessment tools and systems for planning and decision-making that can address lifelines restoration challenges.
  - Utility earthquake impact and risk assessment capabilities remain largely focused on internal assets and systems, and are utilized for internal planning and mitigation decision-making.
  - Collaboration among regional lifelines to share information on assets and systems is still in the discussion stage, and there are no agreed protocols or mechanisms established to address what infrastructure-related information should be shared and how it will be secured, protected, displayed, analyzed, stored, disseminated, and used.
    - Also necessary is deciding what types of data should be shared at three different levels: among utilities, between utilities and local government officials, and with the general public. Each constituency has different needs, and security and legal constraints must be taken into account.
  - While there are proprietary and off-the-shelf capabilities that Bay Area lifelines are currently using, there is as yet no common approach, methodology, process, or standards developed for interdependencies analysis, regional risk assessment, or for information-sharing.

Potential Actions

1. Undertake a **Bay Area Interdependent Lifelines Regional Risk and Resilience Initiative**, building on the nascent EBMUD-PG&E discussions and utilizing the CIKR BAESIC or another appropriate collaborative mechanism to convene key lifelines representatives to develop:
  - The information-sharing procedures and mechanisms necessary to share *operational data among lifelines representatives.*
  - Integrated modeling and assessment capabilities to enable planning and decision-making on restoration and mitigation priorities and investments

2. Develop a **Planning and Decision Guide on Regional Interdependent Lifelines Restoration,** building on discussions already underway by FEMA Region IX, local and state GIS and infrastructure protection officials. The project would include:

   - Holding follow-on workshops with utilities, local officials, and other key stakeholders to familiarize them with:
     - Existing information sharing and other data interoperability capabilities that a number of Bay Area localities, state and federal agencies, and regional organizations are using, such as the California Earthquake Clearinghouse.
     - Interdependencies assessment capabilities (federal and private sector-developed) that can be utilized for preparedness, response, and initial recovery.
     - Criteria, requirements, and protocols for sharing mutually sensitive critical infrastructure information *between lifelines and government agencies* that cover collection, assessment, and dissemination procedures, and which address proprietary information and data security needs.

3. Utilize more-operationally detailed **Lifelines Interdependencies Tabletop Exercises** to further raise awareness of interdependencies impacts at deeper levels under regional disaster scenarios to address potential operational constraints, expectations, and misconceptions about restoration needs and timelines. Findings will be used to support Action items 1 and 2 above and further assist planning efforts of local officials and key private sector and non-profit organizations.

Workshop Objective 2: Enhancing Coordination and Prioritized Allocation of Essential Resources for Major Earthquakes

What's Working

- There are mechanisms that provide mutual assistance for significant events, including CalWARN and CUEA, which can secure personnel and facilitate access and acquisition of resources if a locality is overwhelmed in a significant event. These mechanisms worked well in the aftermath of the South Napa quake.

- Utilities and local governments have become increasingly aware of the importance of building, and taking advantage of, relationships and networks to assist in preparedness, response, and particularly post-event initial restoration activities.

- Lifelines and local governments also are taking measures to ensure contracts are in place with vendors and technical experts, and that essential equipment and components are identified and stockpiled. Some organizations are developing emergency fuel plans and upgrading current continuity plans.

What Still Needs to be Done

- While effective for the South Napa event, for a major earthquake, there will be competition for scarce resources that will overwhelm current local and state mutual assistance mechanisms.

- Bay Area counties and major cities—called under the Standardized Emergency Management System (SEMS) "Operational Areas" (OAs)—have their own projected recovery needs and plans. There is no formal collaborative process to share and discuss OA requirements pre-event that could lead to a flexible regional strategy to prioritize resources in a large-scale disaster.

- Availability and access to fuel for a variety of post-disaster needs (emergency power generators, pumps and other system components, vehicles for transportation of essential staff and maintenance workers, etc.) remains one of the greatest challenges. There as yet is no regional emergency fuel allocation plan.

- Resilient communications remain an issue. Challenges include ensuring pre-event points-of-contact are identified in key utilities and localities, and tested back-up systems are available if cell, landline, and internet services are disrupted.

- Assuring effective coordination among local and state partners to facilitate and prioritize resource allocation in a major event needs further attention.

Potential Actions

4. Undertake a **Regional Resource Coordination Planning Project** through creating, or use of, an existing regional mechanism to bring together Bay Area OA representatives with state, FEMA Region IX, and other federal partners to share requirements and plans, and develop a regional process and strategy to prioritize needs and provision of mutual assistance and other resources in a major earthquake or other catastrophic event. Hold one or more a tabletop exercises to examine and validate the process and strategy. Incorporate project outcomes into the updated Bay Area Earthquake Plan now being developed by FEMA Region IX with Cal OES.

5. **Move forward on a Bay Area Emergency Fuel Plan** focusing on a major earthquake or other large-scale event, involving lifelines and other essential service providers, fuel producers and distributors, OA representatives, and state and federal partners. Evaluate and validate the initial plan with one or more tabletop exercises.

6. Undertake a **Regional Resilient Disaster Communications Projec**t that includes one or more workshops to examine current communications capabilities of lifelines and relevant local agencies, with focus on response and initial restoration and potential gaps, and identify cost-effective actions to make necessary upgrades to communications systems.

7. Develop and conduct a **Regional Disaster Resource Coordination Tabletop Exercise** with lifelines and other essential service providers, local, state, and federal agencies, using a *realistic* major earthquake scenario with extensive damage to, and prolonged disruption of interdependent lifelines to assess the effectiveness and adequacy of current coordination mechanisms to secure and allocate mutual assistance and other resources for response and initial restoration.

Objective 3: Improved Understanding of Processes and Requirements for Post-Disaster Federal Assistance and Reimbursement

What's Working

- California's SEMS and FEMA guidelines provide a process for localities, other public organizations, and certain eligible non-profits to utilize in requesting assistance and reimbursement for services provided after a significant emergency or event. Guidelines and other information on the processes and requirements are available on the internet.

What Still Needs to be Done

- Officials particularly in smaller cities, many local agencies, and public organizations are unfamiliar with state and FEMA requirements, and how the process to access assistance, and documentation should be conducted. This will negate or significantly jeopardize any chance for reimbursement.

Potential Actions

8. Hold **Federal Disaster Assistance and Reimbursement Workshops** in different parts of the Bay Area for localities and other disaster federal assistance-eligible organizations with FEMA and OES instructors to provide detailed training on procedures, requirements, and timelines, and other actions necessary.

9. Disseminate a joint **FEMA/California State and Federal Disaster Assistance and Reimbursement brochure** (in both hard copy and electronic form) that is customized for localities and eligible organizations to be compliant and consistent with SEMS.

Workshop Participating Organizations

AC Transit

AECOM

Alameda County
Office of Emergency Services
Social Services Agency

Alameda County Water District

Alameda Health System

Alameda Municipal Power

Alderwood Water and Wastewater District

American Red Cross

Applied Materials

AT&T

Bank of the West

BART

Bay Area Center for Regional Disaster Resilience

Bay Area UASI

California Governor's Office of Emergency Services

California Highway Patrol

California Resiliency Alliance

California State University Monterey Bay

Caltrans - District 4

California Geological Survey (CGS)
CA Earthquake Clearinghouse

Champion Telecom

City of Alameda Public Works

City of Berkeley
Fire Department

City of East Palo Alto Police

City of Emeryville

City of Hayward Police Department

City of Mountain View

City of Napa

City of Oakland Fire-EMSD

City of Palo Alto OES

City of Pleasanton Police Department

City of Richmond Fire OES

City of San Bruno

City & County of San Francisco
Department of Public Health

City of San Mateo / Foster City

City of South San Francisco

City of Union City

City of Walnut Creek

Clorox Company

Comcast

Contra Costa County

Contra Costa VOAD

CR Solutions

CSAA Insurance Group

David Grant USAF Medical Center

Defense Coordinating Element, FEMA Region IX

East Bay Regional Park District Police

EBMUD

Earthquake Engineering Research Institute

FBI

FEMA Region IX

Fluor/TRS

G&E Engineering Systems, Inc.

Genentech

Goettel & Associates Inc.

Golden Gate Safety Network

Har-Bro Restoration

Jewish Family and Children's Services

Kaiser Permanente

Lawrence Livermore National Laboratory

Livermore-Pleasanton Fire Department

Marin County Office of Emergency Services

Marin VOAD / Marin Interagency Disaster Coalition

McKesson

Menlo Park Fire

Metropolitan Transportation Commission

Mid-Peninsula Water District

NC4

Northern California Regional Intelligence Center

Orbelian Holdings / Yanev Assoc.

PG&E

Pleasant Hill CERT

Port of San Francisco

Safe-T-Proof, Inc.

San Francisco Public Utilities Commission

San Jose Water Company

San Mateo County Health System

Sandia National Laboratories

Saunders & Associates

Seismic Warning Systems, Inc.

Sephora

Seton Coastside

Seton Medical Center

SF CARD

SFFD NERT and California Disaster Corps

Symantec Corp

Team Rubicon

The Brashear Group LLC

TiVo

Transamerica Pyramid Security

U.S. Army AFDD

U.S. Coast Guard

U.S. Dept. of Health and Human Services
Administration for Children & Families
Assistant Secretary, Preparedness & Response

U.S. Dept. of Homeland Security
Office of Infrastructure Protection

U.S. Food & Drug Administration

U.S. Geological Survey

UC Berkeley

Union Sanitary District

Verizon Wireless

VMware

Washington Hospital Healthcare System