Earthquake Risk Management
California Requirements

• Policy to manage earthquake risks
• Program to understand hazards and system vulnerabilities
• Plan to implement risk mitigation options
• Dedicated staff
• Dedicated budget
• Accountability

• California Seismic Safety Commission/CPUC Safety Branch
Pacific Gas & Electric Company, a subsidiary of PG&E Corporation, is one of the largest natural gas and electric utilities in the U.S.

- ~22,000 employees provide gas and electric service to ~16 million people throughout a 70,000 square mile service area
- 5.2 million electric customer accounts
- 4.4 million natural gas customer accounts
- Electric generation (gas and hydro), gas storage, transmission and distribution
Transmission
- ~18,100 circuit miles
- ~90 transmission substations
- ~60 switching stations

Distribution
- ~141,000 circuit miles
- ~600 distribution substations

2014 Cap Ex Spend
- Transmission - $1 billion
- Distribution - $1.9 billion
Profile

Transmission
- ~6,400 miles

Distribution
- ~42,400 miles

Storage
- 3 underground gas storage facilities
  - McDonald Island, Los Medanos and Pleasant Creek

2014 Cap Ex Spend
- Transmission - $400 million
- Distribution - $700 million
- PSEP - $400 million
Capital Expenditures 2014-2016

* Range reflects recent regulatory decisions, current or planned regulatory filings, and historic spending patterns and includes ~$400 million in 2015 and ~$300 million in 2016 ($689 million total) for estimated capital disallowed in April 9 final penalty decision.

(1) 2014 recorded capex includes ~$400 million that has already been reserved for PSEP capital that exceeds authorized amounts.

See the Safe Harbor Statements for factors that could cause actual results to differ materially from the guidance presented and underlying assumptions.
How Does PG&E Currently Use (or Not) Hazard Information from the USGS National Seismic Hazard Maps

Buildings

- **Pre - ”maps” retrofits**
  - Deterministic e.g. M7.8 San Andreas
  - Median for LS or IO, 1-sigma for CP

- **Post - ”maps” retrofits**
  - ASCE 41 or other prescriptive methods
  - Advanced Seismic Assessment Guidelines

- **New construction**
  - California Building Code
  - Seismic Risk Categories II, III, IV
How Does PG&E Currently Use (or Not) Hazard Information from the USGS National Seismic Hazard Maps

**High Voltage Electric Equipment**

- **New Equipment**
  - IEEE 693 Standard
  - High, Medium, and Low Hazard Zones
  - Use Hazard Maps to determine which bin

- **Anchorage Retrofits**
  - California Building Code
How Does PG&E Currently Use (or Not) Hazard Information from the USGS National Seismic Hazard Maps

Dams

- Currently Deterministic
  - DSOD and FERC establish criteria
  - Median for low slip rate faults
  - 1-sigma for high slip rate faults

- Future PSHA Framework
  - PG&E fault file
  - SSC and GMC logic tree models
  - Uncertainty is included
How Does PG&E Currently Use (or Not) Hazard Information from the USGS National Seismic Hazard Maps

**Other Generation**

- **Nuclear**
  - Recent Seismic Hazard Re-evaluation use a PSHA using an updated SSC and GMC as inputs
  - Current Licensing Basis is a M7.5 Hosgri earthquake, 84\textsuperscript{th} percentile ground motions
  - 10,000-year return period ground motions

- **New Fossil Power Plants**
  - California Building Code
Ideas for Future Development of Hazard Mapping

- Geo-Hazards
  - Probabilistic fault displacement
  - Probabilistic landslide displacement
  - Liquefaction hazards – lateral spread contours

- Path Effects
  - Site specific factors
  - Denser array of sensors

- Scenario Earthquakes
  - More EQ scenario ShakeMaps
  - Geo-Hazard scenario maps
Thank You