

American Osteopathic College of Occupational and Preventive Medicine
2014 Annual Meeting, Seattle, Washington

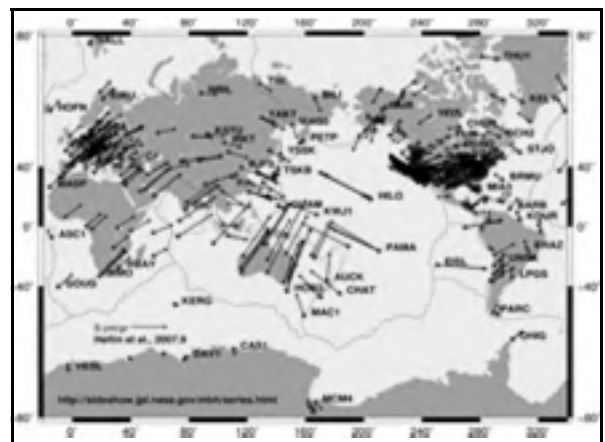
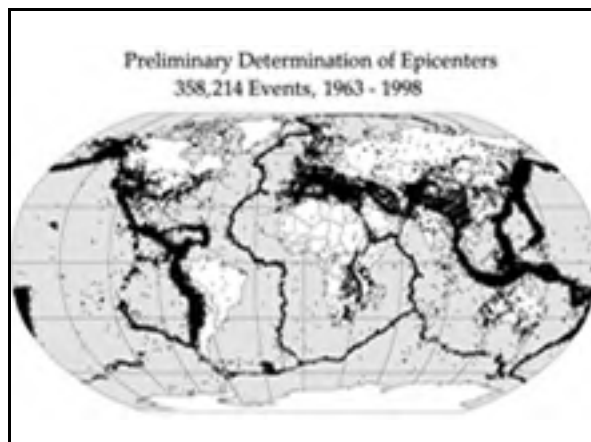
“Earthquake Preparedness
for Civic Leaders”

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Learning Objectives

- Risk of earthquakes in US
- Lessons learned from recent events
- Possible social and economic impacts
- How to prepare for it
- What more can we do?

“The greatest threat is when the
overwhelmed public no longer
prepares for the looming disaster
that could hit us.”



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Basics of Richter's Scale on Earthquakes

- Micro- 2.0 or less
- Moderate- 4.5 or greater
- Strong- 6.3 or greater
- Great- 8.0 or higher

What do the numbers mean?

- From 6 to 7 on the Richter Scale, the magnitude is 10X
- Each whole number represents about 31 times more energy than the amount released by the previous number

Southern California Earthquake

- 5.1 to 8.1 on the Richter Scale
- 1000 X in magnitude
- Energy released is 29,791 times

Warnings and lessons from Mother Nature

- Indian Ocean Earthquake Dec 26, 2004(9.1)
- Haiti Earthquake Jan 12, 2010(7.0)
- Japanese earthquake March 11, 2011(9.0)
- Southern CA March 28, 2014(5.1)



Indian Ocean Earthquake and tsunami Dec 26, 2004

- 9.1-9.3 magnitude, 8.3-10 minutes
- 370 years of US energy use
- More than 13 countries affected
- Deaths 184,167 Injured 125,000
Missing 45,752 Displaced 1.69 mil
- Cost of aid and reconstruction \$7.5B

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Key Lessons?

- Relatively low cost
- Massive loss of life
- Little or no warning system of incoming tsunami
- Massive displacement of local populations

Haiti Earthquake Jan 12, 2010

- 7.0 magnitude, \$7.2-\$13.2 B
- Killed 230,000 persons and injured 300,000, according to CDC
- 2 million sought temporary shelter



Key Lessons

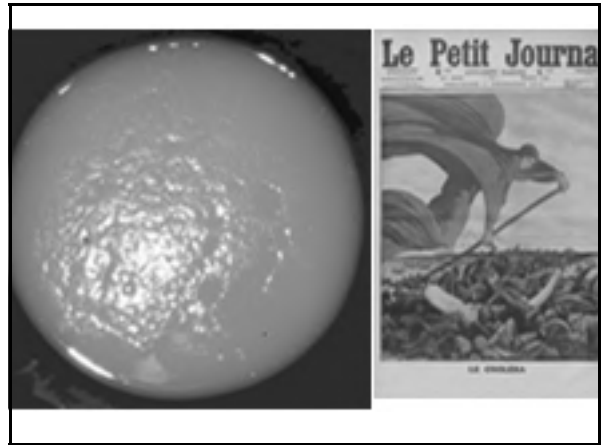
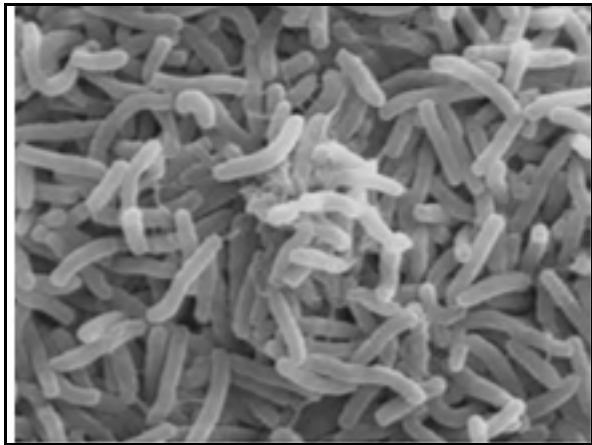
- Weakened or already corrupt government institutions led to worse social upheavals
- Lack of security for responders
- Earlier engineering response can alter the trajectory of this disaster
- Cholera emerging as a public health threat

Cholera outbreak Oct 22, 2010

- July 31, 2011, introduced by Nepalese peacekeepers
- 419,511 cases CDC vs 600,000 (Washington Post)
- 222,359 hospitalized
- 5,968 vs 8000 deaths



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Japanese Earthquake March
11, 2011

- Ten days later, nearly 900,000 households are still without water
- Twelve days later
 - 243,000 homes without power
 - 720,000 homes without potable water.
- The World Bank's estimated economic cost was US\$235 billion

Extent of Damage

- National Police Agency reported
 - 15,883 death
 - 6,145 injured
 - 2,656 missing
- Structural (buildings) Damage
 - 129,225 totally collapsed
 - 254,204 half collapsed
 - 691,766 partially damaged



Bad to Worse

- Cold weather with rain delayed search and rescue, increasing risk of mudslides?
- No preparation can really make big difference?





The Japanese People's Unusual Behaviors

- No riots
- No looting
- Stoic, calm and patience in face of disaster of this magnitude.
- No report of people cutting head of line?

Japanese Earthquake Lessons

- Low mortality but still a public health catastrophe
- The more advanced economies, the greater the cost

Japanese Earthquake Lessons

- Basic supplies shortage will affect regions far from epicenter
- Our defense is easily overwhelmed by Mother Nature



Earthquakes in the United States

- Not confined to West Coast
- 97% chance of a major Earthquake in the new Madrid seismic zone of Central US between now and 2034



“Experience teaches
efficaciously but brutally”

French Economist Bastiat

Earthquakes in California

- California has more than a 99% chance of having a magnitude 6.7 or larger earthquake within the next 30 years, according to scientists.

The California Statistics

- 8th economy in the world
- Roughly 40 million people, with 24 millions in Southern California
- Populations at risk?
- Three counties at risk with surrounding counties severely affected

The California Complications

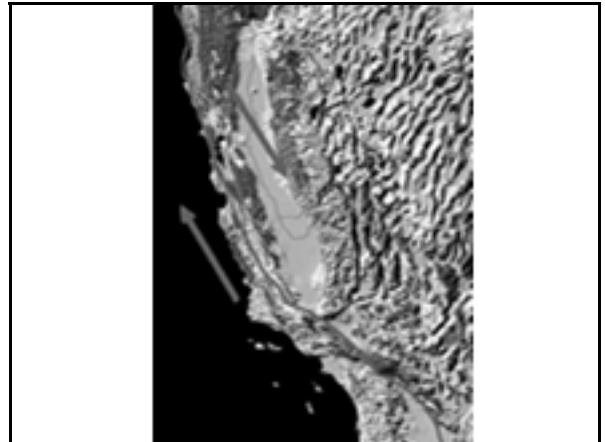
- Unique from the Japanese and Haiti Earthquakes
- Very multicultural populations-at peace but not necessarily on the greatest terms with each other

The California Complications

- Stoic, patient and harmonious character of the Japanese will not be there
- Racial strife that may take a generation to heal

The California Earthquakes

- 1857 Fort Tejon earthquake-resulted in 2 deaths at 7.9 magnitude
- 1906 San Francisco earthquake-About 3000 people died in the earthquake and subsequent fires, 7.8
- 1989 Loma Prieta earthquake: near Santa Cruz, causing 63 deaths at 6.9



San Andreas Fault

- The Southern segment, which stretches from Parkfield in Monterey County all the way down to the Salton Sea, is now capable of a Richter scale 8.1 earthquake.

San Andreas Fault

- Thomas Jordan, Director of the Southern California Earthquake Center, San Andreas fault is "locked and loaded"
- No event over 150 years!

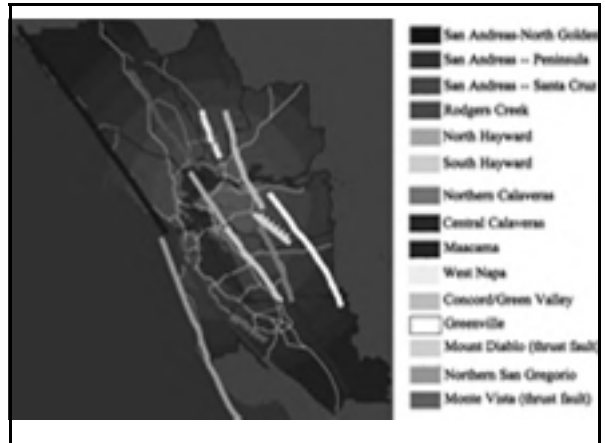
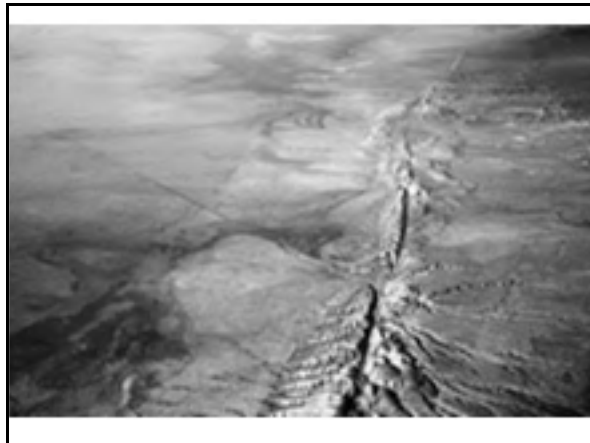
The Big One in California

"Could happen in the next 10 minutes to the next 30 years," according to California State Geologist John Parrish.

San Andreas Fault

- An earthquake of that size on the Southern segment-could kill thousands of people in
 - Los Angeles
 - San Bernardino
 - Riverside, and other areas
- cause hundreds of billions of dollars in property and economic damage

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What will happen in the case of the “Big One”?

- Amount of Energy Released
- The earthquake in Japan generated enough energy for the US to use for the next 100 years.
 - The possible one in CA can provide enough energy use for the next 20 years.

Northridge Earthquake compared to the Big One

- 6.7 vs 8.1 (Richter Scale)
- 20 seconds to minutes
- 40 times in magnitude
- 384 times in energy released
- Fatalities 57 vs ?
- 9000 injured vs ?

Northridge Earthquake

- 11 local hospitals were damaged.
- 100,000 houses and businesses were damaged.
- Estimated cost \$40 billion dollars

The Big One

- In test scenario, deep-rolling seismic waves move nearly 200 miles across southern California landscape, leaving a wake of devastation
- 2000 deaths, 50,000 injured, and 4000 fires
- No water for SIX MONTHS

Southern CA Mega Earthquake

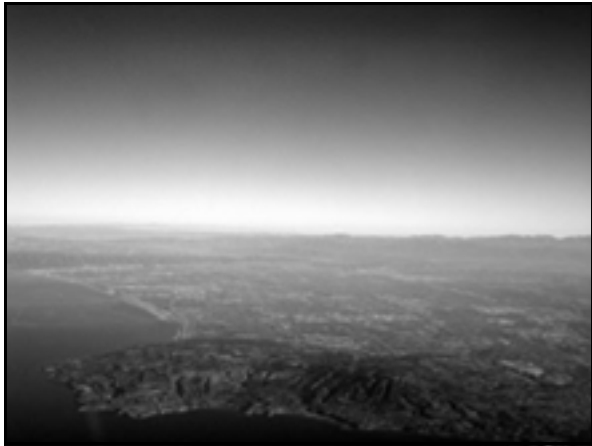
- Infrastructure
- Energy supply
- Food, water, and basic supplies
- Health care facilities
- Schools
- Communications
- Law enforcement
- Home/cars

Infrastructure-inevitable interruptions

- Hamper medical disaster response
- Affect basic need supply distribution
- Severely affect local, regional, national economy



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Northridge Earthquake

- 3% of bridges were damaged on a 6.7 on the Richter Scale
- Total repair cost \$150 million dollars
- Six collapsed bridges alone cost \$121,765,750 dollars

Number of Bridges by Counties

- Los Angeles County 3,650 bridges
 - Damaged 228 in Northridge
- Riverside 982 bridges
- Orange 968 bridges



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Regional Complications?

- Counties not directly hit by earthquake will be severely affected
 - Food and other goods distribution will be impaired by damaged infrastructure and social unrest.
- Tokyo was facing shortage of consumer products at 2 wks after earthquake.

National Impact?

- Southern California has two largest container shipping ports in the country
 - Wheat, corn and agricultural products cannot be exported
 - Imported goods cannot reach interior

Global Impact?

- California as a "stand alone" country is the 8th economy in the world
 - 50% container trade with Asia goes to the West Coast ports
- If only one part of the national rail system is interrupted, trade will stop with much of Asia



What about airports?

- Six airports serve the LA area
- LAX alone accounts for 63,688,121 passengers 2012
 - LAX 87 domestic and 69 international destinations
 - Total 605,480 landings and take offs- 1,658 per day or 69/hour
- Busiest origin and destination airport in the world in 2011

Energy Supply

The Nuclear Power Plants?

- Nationally We derive 20% of our energy need from nuclear power.
- Two nuclear power plants in California: San Onofre and El Diablo Canyon Power Plant

What About Oil Refineries?

- Currently, there are 13 refineries in California that produce gasoline.
 - Southern California includes:
 - BP (Carson)
 - Chevron (El Segundo)
 - Shell (Wilmington)
 - ExxonMobil (Torrance)
 - ConocoPhillips (Wilmington)
 - Valero (Wilmington)



Torrance Refinery Facilities

- Processes an average of 150,000 barrels of crude oil per day
- Produces 1.8 billion gallons of gasoline per year
- Produces nearly 10 percent of the gasoline that is refined in California.

Implications of Damage to Refineries:

- Return of the gas lines with skyrocketing prices
- Fights could erupt from long lines
- Provides jet fuel to Los Angeles International Airport via PIPELINE

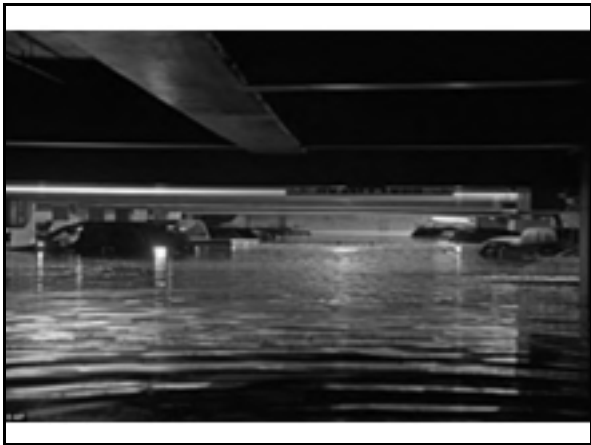
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Food, Water and Basic Supplies

- How much one needs daily?
- 1 gallon of water for drinking
 - 5 gallons for washings and cleaning
 - 2000 kcal, hopefully variety of food choices

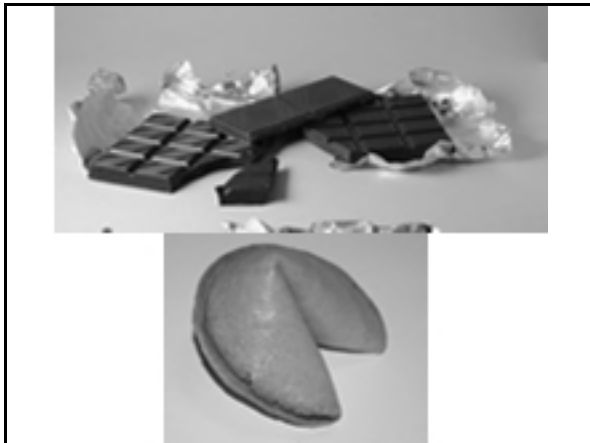
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Where are other resources?

- US Senator Barbara Boxer's Office
- American Red Cross
- FEMA Website

Health care facilities



ICU and Hospital Capabilities

- 3000 ICU beds dropped to 100 in Northridge Earthquake?
- Where can patients go?

What Kind of Injuries?

- Crush injuries
- Infections to follow
- Lack of chronic medications lead to wide range medical emergencies
- If public health breaks down, gastrointestinal illnesses will predominate

Hospital Preparedness?

- Backup electrical power will last probably hours, days? Limited by fuel storages
 - Medications storage problem?
 - Blood products
- Oxygen supply for patients?
- What about patients on vents?

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Hospital Preparedness?

- Elevators-inoperable, death traps for so many of our patients
- Supply of IVFs, other medications?
- Drug Delivery "pneumatic tube system" will not work? Nightmare in best case scenario

Hospital Preparedness?

- Water supply-there never was a need to store water?
- Dialysis patients will die very quickly without water for hemodialysis-at least 50 gallons/patient X 3/week.
- Cleaning and sterilizing of surgical equipments?

Schools

- Parents may scramble to pick up children
- May present a big problem with roads are not accessible

Communications

- Phones will not work due to overload
- Data network will be overwhelmed
- Do not call unless absolutely necessary



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Law enforcement





Unpleasant Possibility?

- Police will need rescuing themselves?
- City Hall and other local government agencies?
- Prison systems, county jails

Law enforcement challenge?

- How many days of supply of food and water in a typical patrol car?
- Police station?
- City Hall?
- Local schools and other institutions
- We are the contingency plans of NGOs?

Home or Car

- How long will your water supply last?
- How long can you survive?
- What about supply of chronic medications?





Solutions?

- Heed American Red Cross and FEMA Earthquake preparedness guidelines
- Digitize important documents



Biggest Difference Citizens Can Do?

- Store water and other food supplies
- One month supply of chronic meds
- Cash?
- Authorities will have more time to focus on firefighting, infrastructural repairs, medical response.

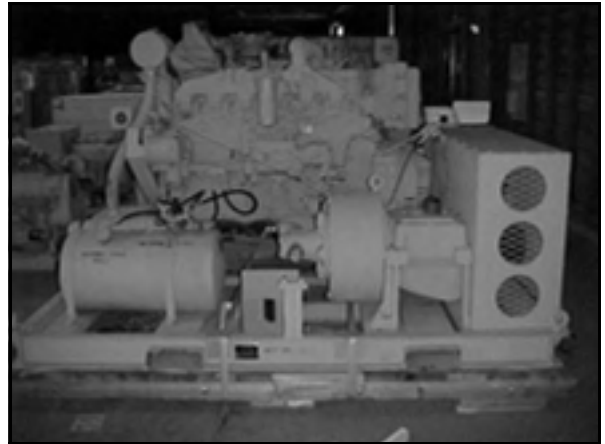
Potential Solutions?

- The US Navy may have a role to play in all this.
 - GW Aircraft Carrier can generate 400,000 U.S. gallons (1,500,000 L) of potable water a day
 - Easily supplied to strategic locations on the coast.



Potential Solutions?

- The US Marines Engineering Units can play a big role as well
 - Reverse osmosis units can be anchored along the beaches
 - Water distribution lines can easily reduce the water need of Southern California



“Knowing is not enough,
we must apply.
Willing is not enough, we
must do”

Johann Wolfgang von Goethe