By Anne Obersteadt, CIPR Senior Researcher

**INTRODUCTION**

According to the United States Geological Survey’s (USGS) latest report, 143 million people across 48 states are now at risk for damage from an earthquake. The most active seismic areas in the U.S. are along the West Coast plate boundaries of California, the Pacific Northwest and Alaska. Earthquakes of smaller magnitude throughout other parts of the U.S. also have the potential to cause damage. In recent years, there has been an increase in earthquake activity in certain parts of the central and eastern U.S. known for oil and gas extracting. These practices have prompted a great deal of debate on the potential link between activities related to hydraulic fracturing and earthquakes. Additionally, there are rising concerns the Cascadia Subduction Zone, which runs through California, Washington, and Oregon, is overdue for a mega earthquake.

To better understand these changes, insurance regulators gathered during a recent Center for Insurance Policy and Research (CIPR) event to discuss concerns surrounding issues and challenges related to earthquake exposure. The event, *All Things Earthquake*, was held during the NAIC Summer National Meeting and boasted more than 200 attendees. It was hosted by Oklahoma Insurance Commissioner John D. Doak and featured a keynote address from the California Earthquake Authority (CEA). The event also included scientific presenters, an insurance regulator panel and a stakeholder panel, with the panel discussions being moderated by Commissioner Doak and Mississippi Insurance Commissioner Mike Chaney. This article will highlight the findings and discussions related to earthquake coverage and policy issues, the latest scientific findings and the role of loss mitigation.

**INDUCED SEISMICITY CAUSATION**

There has been a great deal of scientific research aimed at finding the causation for the large increase in seismic activity over the past several years in the central and eastern U.S. Prior to 2009, the central and eastern U.S. averaged only about 20 earthquakes with a magnitude of 3 (the point at which an earthquake can be felt) or greater per year. For the 2010–2013 periods, this number jumped to an average of more than 100 earthquakes with a magnitude of three or greater.¹ The USGS has linked the increase in earthquake activity in these regions to waste water disposal from hydraulic fracturing operations. In a study released in April, the USGS identified 17 areas within eight states in the central and eastern U.S. with increased rates of induced seismic activity. These eight states are: Alabama, Arkansas, Colorado, Kansas, New Mexico, Ohio, Oklahoma and Texas, with Oklahoma showing the sharpest increase in induced seismic activity.²

Kyle Murray, a hydrogeologist with the Oklahoma Geological Survey (OGS), told the audience Oklahoma has been experiencing a much higher number of larger magnitude earthquakes in recent years not typical of a natural earthquake pattern. He advised that by May 2014, Oklahoma had exceeded its historic number of magnitude three earthquakes in any given year. Oklahoma had 585 earthquakes in 2014 and is on pace to have five times as many earthquakes in 2015. This compares to just 547 earthquakes occurring in the 38-year time period between 1970–2009.

The OGS responded by issuing a joint statement with the USGS in October 2013 to notify the public of the increase in this hazard. The statement indicated central Oklahoma was at greater risk for experiencing a damaging earthquake with a magnitude of 5.5 or higher due to the rise in earthquake activity.² In May 2014, the OGS again joined the USGS in stating its scientific findings indicated a likely link between induced seismic activity and waste water disposal from hydraulic fracturing.

Hydraulic fracturing is a method in which large quantities of water, chemicals and sand are injected into gas-producing shell rock beds. The high pressure injection creates fractures in the shale formations, allowing gas to be extracted. The millions of gallons of waste water resulting from hydraulic fracturing are usually disposed of in deep wells.

“The consensus is yes, we have an increased number of earthquakes that is not completely natural,” Mr. Murray said. “A component of them is man-made, with the most likely contributing factor being the injection of saltwater into the deep subsurface right above the basement rock.”

Disposing into the zone right above the basement rock, called the Arbuckle, presents issues because the basement rock is where earthquakes occur. “If that fluid has a chance

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to migrate into the basement rock, it could trigger critically stressed faults,” Murray explained.

Hydraulic operators in Oklahoma use seven to 10 barrels of water per barrel of oil extracted. The median water concentration of the extracted water is about five times as salty as sea water because operators in the state have been producing in more water-saturated zones. The high salt content of the waste water makes it difficult and expensive to recycle and reuse.

“It’s not very economical in Oklahoma to recycle and reuse the waste water,” Mr. Murray said, “so we dispose of it into saltwater disposal wells, which can cause seismicity problems.”

In addition to depth, scientists have also found other key factors for induced seismic activity relate to the volume, location and distance of saltwater disposal. For instance, Mr. Murray explained, the salt water disposal wells in Oklahoma are very closely located to one another. Arkansas had a similar experience when the energy industry started developing the Fayetteville Shale in 2009.

As Steve Horton, a geophysicist at the University of Memphis Center for Earthquake Research and Information (CERI) explained, “Within a year, [oil and gas operators] had opened eight disposal wells located in a small area. When they started injecting fluid, we began having a lot of earthquakes.”

In September 2010, seismologists in Arkansas took notice of a cluster of small earthquakes in the fault located in the Guy and Greenbrier towns. They noted the earthquakes trailed the injection of fluid in two nearby wells. Three months later, Mr. Horton and his colleague, Scott Ausbrooks (Arkansas Geological Society—AGS), took the lead in a study initiated by the Arkansas Oil and Gas Commission (AOGC) to investigate the earthquakes. The study compared daily disposal data from operators to the seismic data collected in the area. During the study, the earthquakes near the Guy-Greenbrier area continued to grow in magnitude. Following a record 4.7 magnitude earthquake in February 2011, the AOGC responded by temporarily closing down the two wells in question. The rate and size of the associated earthquakes steadily dropped over the three months following the wells closures.

In a July 2011 hearing, the AGS and CERI presented evidence from their study definitively linking water injection pressures and seismic activity. As a result of the study’s findings, the AOGC permanently closed four wells directly associated with most of the earthquakes. It also created a 1,150-square-mile moratorium area in the Fayetteville Shale restricting new injection wells. Additionally, a number of rules on where disposal wells can be located outside of the restricted area were established. Arkansas has experienced decreased seismic activity since implementing these liquid-disposal techniques and disposal location restrictions.

“One of the main lessons we learned was induced seismic hazard can be minimized through liquid-disposal management strategies,” Mr. Horton said.

Mr. Murray promoted recycling and reusing waste water as another key strategy in reducing saltwater disposal volumes and ultimately seismic activity. Additionally, he said it was important to undertake research to understand what factors make a fault more prone to being triggered. It appears larger induced earthquakes occur along critically stressed pre-existing strike-slip faults. There is general scientific consensus an induced earthquake would not be likely to exceed a magnitude of six. However, Mr. Horton cautioned there is some potential for a triggered earthquake to produce higher magnitude earthquakes, given sufficient energy. For this reason, he advised that injecting into faults such as the New Madrid Seismic Zone is not advisable.

Earthquake Insurance Across the States
Despite the increased exposure to damage from seismic activity, purchase of insurance covering earthquake losses remains low across the U.S. Glen Pomeroy, CEO of the CEA, told the audience about one million people in California have earthquake insurance on their homes today. The CEA currently accounts for approximately 75% of the residential insurance on these homes. However, more than 90% of Californian homes still do not have earthquake insurance. This is a concern because scientists predict there is a virtual certainty of a 6.7 or greater magnitude earthquake in California within the next 30 years.

The CEA is a publicly managed, privately funded entity offering residential property insurers the ability to partner with the CEA to sell its earthquake policies. It was created to fill the homeowner’s insurance void in California created by the severe market restriction following the 1994 Northridge earthquake. This was one of the costliest earthquakes on record. Since its creation, the CEA has grown to be one of

(Continued on page 23)

6 California Earthquake Authority; Our Research. Retrieved from www.earthquakeauthority.com/whoweare/Pages/research.aspx
the largest providers of residential earthquake insurance in the world.

Earthquake insurance coverage in Missouri is also a concern. In August, the Missouri Department of Insurance (DOI) issued its latest State of Earthquake Coverage report showing earthquake insurance coverage for residences in the southeast corner of the state near the New Madrid Seismic Zone had fallen to 20% in 2014, down from more than 60% in 2000. The statewide take-up rate is 31%. Ms. Angela Nelson, Director, Division of Market Regulation, Missouri DOI, told the audience Missouri is at a tipping point.

“The amount of uninsured residential property will soon eclipse the amount of insured residential properties in the state,” Nelson said. “This could significantly hamper our state’s ability to recover should a significant earthquake event occur.”

In 2014, insured residential properties totaled $101 billion. Uninsured residential property damage from a magnitude 7–7.9 earthquake was estimated to result in $100 billion in property losses.7

While rates increased only modestly throughout much of Missouri, the rates in the highest risk areas of the southeast corner of the state, known as the boot heel, have increased much more rapidly. This has widened the costs between high and low risk areas. Ms. Nelson said counties in the New Madrid Seismic Zone experienced rate increases up to 7,000%, which has driven premiums from around $57 per year in 2000 to as high as $1,400 per year in 2014. Deductibles have also increased, with more than 40% of the market in Missouri having deductibles in excess of 20%.

Additionally, Ms. Nelson said, “Forty-four percent of our companies by market share have underwriting restrictions that would prevent Missourians in the southeast boot heel from being able to buy coverage.”

In Oklahoma, a dramatic rise in seismic activity in recent years has raised awareness of a need for earthquake coverage. Based on an informal survey of the state’s largest insurers, the Oklahoma Insurance Department estimated earthquake insurance take-up rates rose from 2% in 2011 to 15% in 2015.8 Gordon Amini, General Counsel, Oklahoma Department of Insurance, told the audience he does not believe Oklahoma has an issue with pricing or capacity. Although, there was concern insurers might be inappropriately denying claims. In a separate data collection from the state’s larger earthquake insurance companies, the Oklahoma Insurance Department found only eight out of approximately 100 earthquake claims filed in 2014 were paid. 9

Alaska Insurance Director Lori Wing-Heier said insurance capacity and pricing has been a problem in her state. “We are a smaller state in respect to the number of insurance companies we have doing business,” she said.

Additionally, she said many consumers have trouble affording higher deductibles. Depending on the policy, deductible amounts are usually either 5% of the value of the property or the value of the loss. Tsunami risk following an earthquake is another concern for Alaska and other coastal states such as California, Oregon and Hawaii.

“To give you a little bit of a perspective on what a tsunami can do, we lost 139 people in the 1964 9.3 magnitude Alaska earthquake,” Director Wing-Heier said. “The wave reached over 200 feet. So they can be extremely powerful.”

**Earthquake Insurance Barriers**

Earthquake insurance is important because it decreases the post-earthquake loss burden on individuals, businesses and society in general. It serves as a pre-disaster funding tool by transferring the risk of earthquake damage and funding recovery efforts. However, many consumers opt not to purchase earthquake insurance coverage to protect themselves and their property. Mr. Pomeroy said he believes the largest barrier to purchasing earthquake insurance is concern about the cost and value of the insurance.

Risk perception is also a barrier. Earthquakes in many areas are a low-frequency, high-severity peril and, as such, it usually takes a significant earthquake to remind consumers of the risk they face. “Over time and in the absence of a large earthquake, people forget about the risk they face,” Mr. Pomeroy said.

Rob Walling (American Academy of Actuaries) agreed and said ultimately the decision to buy or not to buy earthquake insurance is a very personal economic decision for states such as California, Oregon and Hawaii.

the home, condo or business owner. “That purchasing decision really does rely on your home economics and finances,” he said. According to Mr. Walling, earthquake insurance rates in California vary from 40 cents to more than $3 per $1000. Outside of California, he said rates are typically between 10 cents and 25 cents per $1000 for earthquake coverage.

According to Mr. Amini, this has a lot to do with perception of risk. “We haven’t had a large earthquake in the central U.S. for some time,” Mr. Amini said. “So, it is difficult to sell a policy that costs several hundred to $1,500 a year when you can’t conclusively say the likelihood of having an earthquake, as opposed to a fire or flood, is material.”

Mr. Pomeroy said other barriers include confusion about coverage, false hope for federal assistance, lack of priority and, for Californians, the CEA outdated offer letter. It is a common misconception earthquake coverage is provided in a homeowners or business insurance policy. Excluding policies in California written through the CEA, earthquake coverage is sold primarily through admitted direct and surplus lines insurers. Coverage is provided mostly as an endorsement to a homeowner’s or business owner’s policy and occasionally as a stand-alone policy. David Kodama, senior director of research and policy analysis for the Property Casualty Insurers of America (PCI), told the audience the typical earthquake policy will provide the insured with coverage for structural damage and optional coverage for content, additional living expenses and things such as building code upgrades. He also said typical deductibles range from 15% to 25%, with the option of buying it down as low as 5% for a higher premium.

One of the principal coverage hurdles for consumers seems to be around the deductible. Director Wing-Heier said she has found consumers in Alaska misunderstand how the deductible works. Additionally, affordability can be a barrier, since earthquake deductibles are usually much higher than those found on homeowner’s policies.

“One of our biggest challenges is making sure consumers know the deductible represents a portion of the insured value of the home that has to be damaged before we start paying a claim,” Mr. Pomeroy said. “Insureds never have to write out a check for the amount they basically self-insure.”

**Exclusion and Coverage Concerns**

Director Wing-Heier pointed out pertinent coverage issues, such as time element coverage, may affect consumers’ ability to recover following a major catastrophic earthquake. Time element coverage ties losses to a specified time frame a risk can be nonoperational following a direct loss. Examples of time element coverage include business interruption and loss of income coverage. Director Wing-Heier cautioned insurance regulators to be cognizant of when time element coverage begins and ends in earthquake policies.

“If you have a catastrophic loss and your infrastructure is gone, [this could cause a problem if] the time element begins the day of the loss and you can’t start rebuilding for a year because society’s basic infrastructure is gone,” Director Wing-Heier said.

She also cautioned debris removal and code upgrades need to be carefully examined when contemplating post-disaster catastrophic recovery needs.

Ms. Nelson said she had similar concerns regarding coverage for replacement costs (the cost to rebuild or repair a home using similar materials) and additional living expenses should Missouri experience a large earthquake in the New Madrid Earthquake Zone. The requirement in many policies stipulating rebuilding must occur on the same damaged lot is also a concern.

“This is a problem in the boot heel, where an earthquake is likely to cause extreme liquefaction and it will be days to evacuate the area,” Ms. Nelson said. “How can we ask insureds to come in and rebuild in six months, when realistically the infrastructure will not be rebuilt for years?”

Earthquake insurance typically only covers direct damage to the property resulting from the shaking of an earthquake. Indirect physical damage resulting from other events triggered by an earthquake is typically excluded. For instance, fire and water damage from burst gas and water pipes is excluded from the earthquake policy, but is covered under a homeowner’s policy. Additionally, physical damage from waves, tidal water and floods resulting from an earthquake are excluded from most earthquake policies, but covered under flood policies. Mr. Walling told the audience there were many coverage issues related to distinguishing between earthquake and water damage that paralleled issues seen after hurricanes in distinguishing between wind and water damage. Given the concern that the Cascadia Subduction Zone may be due for a large earthquake, potentially triggering a tsunami, this exclusion has significant implications.

“If the Cascadia fault goes, you are talking about a 100-foot wall of water, and the tsunami coverage is specifically excluded from those quake policies,” Mr. Walling said. “The rela-

(Continued on page 25)
tionship between quake and tsunami is clearly important.”
Joe Kelleher, an insurance litigator and trial attorney with
Drinker Biddle & Reath, said some earthquake policies
also carve out coverage for earthquakes not naturally
occurring (i.e., induced earthquakes). This would include
earthquakes attributed to waste water injection from
hydraulic fracturing activities. Furthermore, many poli-
cies have anti-concurrent causation provisions excluding
coverage for damage if both a covered and uncovered
peril occur, regardless of whether the predominate cause
of the loss was a covered loss. According to Mr. Kelleher,
coverage would come down to predominate loss under
the majority rule in cases of concurrent causation.

“So long as the cause was a covered peril, then there is
coverage,” Mr. Kelleher said. “If your policy has an an-
ti-concurrent causation clause and an excluded cause led to
the loss, even if an included cause did as well, there is no
coverage.”

The implication could mean insurers may deny losses for
covered perils, such as a fire, if the fire resulted from an
uncovered peril, such as induced earthquakes.

Protecting Consumers
During the event, panelists weighed in on how best to
ensure consumers are sufficiently prepared to deal with
potential earthquake losses. “So many of our nation’s
properties are uninsured or underinsured,” Mr. Kodama
said, “so we have to figure out what measures we can
take.”

He advised that mitigating activities, such as bolting
foundations and using stronger bracing materials, would
be a worthwhile first step in controlling earthquake risk.
In fact, according to a Federal Emergency Management
Agency (FEMA) study, on average, every dollar spent on
loss prevention saves society an average of $4 in future
reduced losses. Furthermore, other studies have found a
$1,000 increase in modern code-related residential con-
struction costs focused on seismic and wind mitigation
would save $6,000 over the life of the house. 10

Mr. Pomeroy told the audience the CEA plans to provide
additional incentives to policyholders who retrofit older
homes. He said California has more than 1 million older
homes built on cripple walls in need of support to pre-
vent them from toppling during an earthquake. Begin-
ning Jan. 1, 2016, the CEA’s new program will give home-
owner’s up to a 20% policy mitigation premium discount
to take simple steps, such as bracing and bolting under-
neath the main floor of older homes. Additionally, the CEA
is expanding coverage options, lowering rates and com-
municating more effectively. Changes will include a 10%
statewide average rate reduction, the option to insure
structure only, or add additional coverages with separate
deductibles. Additionally, the CEA is offering a new mobile
app for agents and consumers and a revamped offer letter.

Director Wing-Heier said Alaska, along with other states,
has been supportive of the Disaster Savings Accounts Act of
2015 (H.R. 2230) to help consumers prepare for cata-
strophic losses. The proposal would amend the tax code to
allow consumers to set aside up to $5,000 annually to pre-
pare owned or rented properties for a catastrophic event.
The savings account could be used instead of an insurance
policy or to pay for large deductible amounts. 11 Addi-
tionaly, the Alaska Division of Insurance issues a press release
every Good Friday, the anniversary of Alaska’s 1964 earth-
quake, to educate consumers on protecting their home
from earthquake risk. Director Wing-Heier said her depart-
ment starts with the premise everyone can afford some
level of basic earthquake coverage.

“Maybe [consumers] can’t afford contents,” she said, “but if
they at least insure the structure, they will have four walls
and a roof over their heads and heat.”

Ms. Nelson said Missouri Senator Wayne Wallingford intro-
duced a bill Feb. 3 aimed at increasing earthquake insur-
ance availability, especially in the southeast portion of the
state experiencing extreme pricing and decreased capacity.
The bill (MO SB394) would have allowed homeowners ins-
urance companies to offer earthquake coverage under
Missouri’s FAIR plan, the Missouri Basic Property Insurance
Inspection and Placement Program. 12

“Unfortunately, the bill was not successful,” Ms. Nelson
said, “but it was a good first step to introduce the conversa-
tion on finding solutions with our policymakers.”

Commissioner Doak said Oklahoma has been focused on edu-
cating agents and insurance adjusters on the specifics of
earthquake policies. His department found most agents and
adjusters were unclear on how earthquake policies and de-
cductibles worked. As a result, he issued a bulletin March 3
requiring insurance adjusters and agents to receive a certain
amount of continuing education focused on earthquake loss

10 A Public Policy Primer on National Disaster. (n.d.). Insurance Institute for Busi-
ness and Home Safety. Retrieved from https://disastersafety.org/ibhs-public-
policy/a-public-policy-primer-on-disaster-safety/.

(Continued on page 26)
training. The state has since seen several thousand agents go through this additional training, with very positive feedback. “We really needed to make sure our agents were educated and understood the policies as the first line of defense,” Commissioner Doak said. “It has worked very well in our state, and others may want to follow suit.”

The March 3 bulletin also addressed concerns insurers were inappropriately denying claims based on exclusions for man-made damage. It specified the Oklahoma Insurance Department would expect insurers to prove their case should they deny claims based on man-made exclusions, thus preventing the insured from having to litigate every denied claim. Additionally, it stipulated insurers have an obligation to inspect covered properties at coverage inception to eliminate the potential for inclusion of pre-existing damage in a claim.

Mr. Amini told the audience Oklahoma has since seen an expansion of earthquake policies specifically covering induced earthquakes by removing the man-made exclusion. Additionally, some writers in the state are waiving the man-made exclusion. An updated bulletin was issued July 17 to advise consumers new policies are available in both the admitted and nonadmitted market providing for coverage in a way that eliminates exclusions for induced seismic activity. To ensure policyholders understand their particular policy’s coverage for induced seismic activity, Commissioner Doak issued another bulletin Oct. 20. The bulletin requested that property and casualty insurers provide a “clarifying notice” to policyholders regarding their policy’s coverage for induced earthquakes. 13

California has also recently seen innovative insurance policies enter their private insurance market. Mr. Pomeroy said an insurer recently came to market with a homeowners policy providing a discount on the homeowner’s side if the policyholder had a separate underlying earthquake policy. He believes other insurers will begin to offer similar products by recognizing the policyholder should be rewarded on the homeowner’s side too for protecting the home from earthquake risk. He emphasized innovation comes as a collaborative effort between industry and regulators.

“It is within the regulator’s power to help move public policy,” Mr. Pomeroy said. “Yes, it is a difficult risk, and rates must be actuarial sound, but being creative brings innovation to market.”

**CONCLUSION**

The CIPR Event illustrated the nation’s growing exposure to earthquake risk and the importance of how the insurance industry plans to prepare for earthquakes. Damage from earthquakes can devastate a home, business, city or even a region. Earthquake insurance is an important part of disaster recovery, as it provides policyholders with the means to rebuild. However, much of our nation’s property is not insured or underinsured and, therefore, at risk from earthquake damage.

As such, it is important insurers, state insurance regulators and other stakeholders work collectively to educate consumers on the need for appropriate earthquake insurance coverage and mitigation techniques. This is particularly important in areas experiencing an increase in seismicity, such as the Central and Eastern U.S. Commissioner Doak underscored this point during the event when he compared two homes he visited following a 5.6 magnitude earthquake in Oklahoma. Both homes sustained major damage, but only the homeowner with earthquake coverage could afford to rebuild. “We need to raise the education,” he said.

**ABOUT THE AUTHOR**

Anne Obersteadt is a researcher with the NAIC Center for Insurance Policy and Research. Since 2000, she has been at the NAIC performing financial, statistical and research analysis on all insurance sectors. In her current role, she has authored several articles for the CIPR Newsletter, a CIPR Study on the State of the Life Insurance Industry, organized forums on insurance related issues, and provided support for NAIC working groups. Before joining CIPR, she worked in other NAIC Departments where she published statistical reports, provided insurance guidance and statistical data for external parties, analyzed insurer financial filings for solvency issues, and authored commentaries on the financial performance of the life and property and casualty insurance sectors. Prior to the NAIC, she worked as a commercial loan officer for U.S. Bank. Ms. Obersteadt has a bachelor’s degree in business administration and an MBA in finance.

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