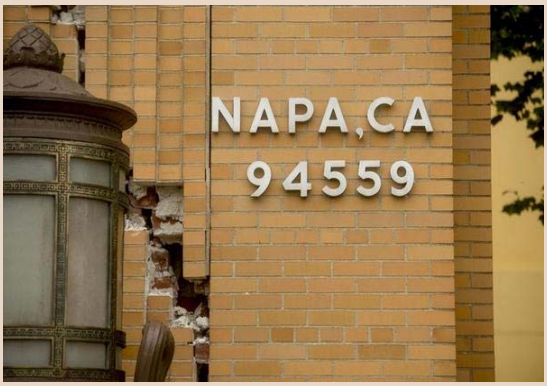
WSSPC
WESTERN STATES
SEISMIC POLICY
COUNCIL

2014 Annual Report



Western States Seismic Policy Council

801 K Street, Suite 1236, Sacramento, CA 95814

916-444-6816 wsspc@wsspc.org

DISCLAIMER

Cover image: *Top Left*- Damage is seen at the US Post Office Building in Napa, CA following the August 24, 2014 M6.0 earthquake. (*www.pressdemocrat.com*) *Top Right*- Historic winery building at Trefethen Family Vineyards left askew after the earthquake. (*www.sfgate.com*) *Bottom*- Resident cranes his head down into a deep fissure. (*napavalleyregister.com)*

2014 WSSPC ANNUAL REPORT
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Section E: 2014 State, Province and Territory Earthquake Program Reports

ACKNOWLEDGMENTS

The Western States Seismic Policy Council (WSSPC) is a 501(c)(3) non-profit organization funded by the Department of Homeland Security/Federal Emergency Management Agency (FEMA). Funding for the WSSPC 2014 Annual Report was provided through FEMA Cooperative Agreement EMW-2014-CA-00189-S01. The Annual Report summarizes seismic policy development and earthquake/tsunami hazard reduction activities conducted by the Western States Seismic Policy Council and its member agencies for the fiscal year that runs from December 1, 2013 through November 30, 2014.

We are grateful to our WSSPC affiliate members who help us defray operating costs not covered by FEMA. The 2014 WSSPC Affiliate members were:

Private Corporation:

California Earthquake Authority, Sacramento, California

Degenkolb Engineers, Inc., San Francisco, California

Saunders Construction, Inc.

State Farm® Mutual, Bloomington, Illinois

Weinstein Construction

Local Government:

City and County of San Francisco, California - Earthquake Safety Implementation Program (ESIP)

City of Las Vegas, Nevada - Building and Safety Department

City of Norwalk, California – Office of Emergency Management

Clark County, Nevada - Building Department

Individual:

Dominic Sims, Chief Executive Officer, International Code Council

Non-Profit Organization:

Applied Technology Council, Redwood City, California

Cascadia Hazards Institute

Earthquake Engineering Research Institute (EERI)

ICC- Evaluation Services

SECTION A

WSSPC Organization

MISSION AND GOALS

The Western States Seismic Policy Council (WSSPC) is a regional earthquake consortium representing thirteen states, four territories, and one province in western United States and Canada. Organized as a 501(c)(3) non-profit organization – and funded by the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) – WSSPC is an important component of the U.S. National Earthquake Hazards Reduction Program (NEHRP), serving as an efficient and effective clearinghouse for earthquake mitigation information and ideas.

WSSPC's primary mission is to develop seismic policies and share information to promote programs intended to reduce earthquake-related losses. Our goals are to:

- Promote regional cooperation and the interaction of the State Emergency Management, State Geological Surveys, and State Seismic Councils and Commissions in the formation of, and advocacy for, seismic policy.
- Improve the overall awareness of earthquake hazards and methods to mitigate the associated risks; develop strategies to enhance earthquake preparedness; and support earthquake studies and earthquake preparedness activities that will reduce or eliminate deaths, injuries and property damage.
- Serve as a resource for earthquake and tsunami-related information, in coordination with other regional and national earthquake organizations.
- Advocate adoption and implementation of seismic mitigation policies at all levels of government.

Members consist of the directors of the state, provincial or territorial emergency management agencies and geological surveys in the WSSPC region, as well as a designated representative for their seismic safety commission, board or council. Members represent diverse constituencies geographically, demographically, and culturally – bringing broad expertise and perspective to the policy table.

Total population of the region served by WSSPC is over 22% of the U.S. and Canada's combined 342 million population, demonstrating the potential reach of policies developed by WSSPC members.

Population Statistics for WSSPC Region

WSSPC Region	Population
USA	**72,214,313.00**
Alaska	710,231.00
American Samoa	55,519.00
Arizona	6,392,017.00
California	37,253,956.00
Colorado	5,029,196.00
Guam	159,358.00
Hawaii	1,360,301.00
Idaho	1,567,582.00
Montana	989,415.00
Nevada	2,700,551.00
New Mexico	2,059,179.00
Northern Mariana Islands	53,883.00
Oregon	3,831,074.00
Utah	2,763,885.00
Washington	6,724,540.00
Wyoming	563,626.00
Canada	**4,433,954.00**
British Columbia	4,400,057.00
Yukon	33,897.00
Grand Total	**76,648,267.00**

Source: 2010 US Census (www.census.gov) and 2011 Canadian census (www12.statcan.gc.ca)

WSSPC BOARD AND STAFF

Chair - John G. Parrish, State Geologist (GS, 2013-2015)
California Geological Survey
801 K Street, Suite 1200, Sacramento, California 95814-3531
john.parrish@conservation.ca.gov

Mark Ghilarducci, Secretary (EM, 2013-2015)
California Governor's Office of Emergency Services
3650 Schriever Ave, Mather, California 95655
mark.ghilarducci@calema.ca.gov

John Madden, Director (EM, 2012 - 2014)
Alaska Division of Homeland Security and Emergency Management
PO Box 5750, Fort Richardson, Alaska 99505-5750
john.madden@alaska.gov

Vicki McConnell, State Geologist (GS, 2012 - 2014)
Oregon Department of Geology and Mineral Industries
800 NE Oregon Street Suite 965, Portland, Oregon 97233
vicki.mcconnell@dogami.state.or.us

Peter McDonough, WSSPC Liaison (AL, 2013-2015)
Utah Seismic Safety Commission
1140 West 200 South/P.O. Box 45360, Salt Lake City, Utah 84145
pete.mcdonough@questar.com

Dave Norman, State Geologist (GS, 2012-2014)
Washington Division of Geology and Earth Resources
PO Box 47007, Olympia, Washington 98504-7007
dave.norman@dnr.wa.gov

Patricia Sutch, Executive Director
Western States Seismic Policy Council
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Michelle Bates, Program Manager
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WSSPC MEMBERS, EARTHQUAKE/TSUNAMI PROGRAM MANAGERS & STATE HAZARD MITIGATION OFFICERS

As of November 30, 2014

Area	Geological Survey Director/ Representative	Emergency Management Director	Seismic Council Liaison	EQ Program Manager/Tsunami Program Manager	State Hazard Mitigation Officer
Alaska	Steve Masterman/ Richard Koehler	John Madden	Buzz Scher	Ann Gravier/ Erv Petty	Ann Gravier
American Samoa	----------	Iuniasolua Savusa	----------	Jacinta Brown	Vinnie Atofau (TEMCO)
Arizona	Lee Allison/ Philip Pearthree	Wendy Smith-Reeve	----------	Michael Conway/Anthony Cox	Darlene Trammell
British Columbia	Stephen Rowins	Rebecca Denlinger	----------	Teron Moore	----------
California	John Parrish	Mark Ghilarducci Mark Johnson	Dick McCarthy	Kate Long/ Kevin Miller	Linda Fong
Colorado	Karen Berry	Dave Hard	Rob Jackson	Scott Baldwin	Marilyn Gally
Guam	----------	James McDonald	----------	Pilar Carbullido	Leo Rustum Espia
Hawaii	----------	Darryll Wong	Paul Okubo	Kevin Richards/ Kevin Richards	Havinne Okamura
Idaho	Michael Ratchford/ Bill Phillips	Brad Richy	----------	Mark Stephensen	Mark Stephensen
Montana	John Metesh/ Mike Stickney/ Debbie Smith	Steve Knecht	----------	Kent Atwood	Kent Atwood
Nevada	Jim Faulds/ Craig dePolo	Christopher Smith	Ron Lynn	Rick Martin	Debbie Tanaka
New Mexico	L. Greer Price/ Dave Love/ Dan Koning	M. Jay Mitchell	----------	Wendy Blackwell	Wendy Blackwell
Northern Mariana Islands	----------	----------	----------	Juan Camacho	----------
Oregon	Vicki McConnell/ Yumei Wang	David Stuckey	Jay Wilson	Althea Rizzo/ Althea Rizzo	Dennis Sigrist
Utah	Rick Allis/ Bill Lund	Kris Hamlet	Pete McDonough	Bob Carey	Brad Bartholomew
Washington	Dave Norman/ Tim Walsh	Robert Ezelle	----------	John Schelling/ John Schelling	Peter Tassoni
Wyoming	Tom Drean/ Seth Wittke/ Martin Larsen	Guy Cameron	----------	Melinda Gibson	Melinda Gibson
Yukon	Carolyn Relf	Michael Templeton	----------	----------	----------

WSSPC MEMBERS' AGENCIES

Area	Agency
Alaska	Alaska Division of Homeland Security and Emergency Management Alaska Division of Geological and Geophysical Surveys Alaska Seismic Hazards Safety Commission
American Samoa	Territorial Emergency Management Coordinating Office
Arizona	Arizona Division of Emergency Management Arizona Geological Survey
British Columbia	Emergency Management British Columbia British Columbia Geological Survey
California	California Governor's Office of Emergency Services California Geological Survey Alfred E. Alquist Seismic Safety Commission
Colorado	Colorado Division of Emergency Management Colorado Geological Survey Colorado Earthquake Hazard Mitigation Council
Guam	Guam Homeland Security & Office of Civil Defense
Hawaii	Hawaii State Civil Defense Hawaii State Earthquake Advisory Committee
Idaho	Idaho Bureau of Homeland Security Idaho Geological Survey
Montana	Montana Disaster and Emergency Services Division Montana Bureau of Mines and Geology
Nevada	Nevada Division of Emergency Management Nevada Bureau of Mines and Geology Nevada Earthquake Safety Council
New Mexico	New Mexico Department of Homeland Security & Emergency Management New Mexico Bureau of Geology and Mineral Resources
Northern Mariana Islands	CNMI Office of Homeland Security & Emergency Management
Oregon	Oregon Emergency Management Oregon Department of Geology & Mineral Industries Oregon Seismic Safety Policy Advisory Commission
Utah	Utah Division of Emergency Management Utah Geological Survey Utah Seismic Safety Commission
Washington	Washington Emergency Management Division Washington Geology and Earth Resources Division
Wyoming	Wyoming Office of Homeland Security Wyoming State Geological Survey
Yukon	Yukon Emergency Measures Organization Yukon Geological Survey

AFFILIATE MEMBERS

As of November 30, 2014

WSSPC welcomes members of the professional community who share our goal of reducing losses from earthquakes and tsunamis. Corporations, local governments or their departments, non-profit organizations, universities, and individuals can join WSSPC as affiliate members; membership fees are used to support program activities not eligible for reimbursement by the federal government.

Corporate	California Earthquake Authority 801 K Street, Suite 1000, Sacramento, CA 95814 *www.earthquakeauthority.com*
	Degenkolb Engineers, Inc. 235 Montgomery, Suite 500, San Francisco, CA 94104 *degenkolb.com*
	Saunders Construction, Inc. 1760 Monrovia, Unit #A-1, Costa Mesa, CA 92627 *www.saundersseismic.com/index.php*
	State Farm Insurance Companies One State Farm Plaza, Bloomington, IL 61710 *www.statefarm.com*
	Weinstein Corporation 15102 Raymer Street, Van Nuys, CA 91405 *https://www.retrofittingcalifornia.com/*
Local Government	City of Las Vegas Building and Safety 333 N. Rancho Drive, Las Vegas, NV 89106 *lasvegasnevada.gov/Government/buildingandsafety.htm*
	City of Norwalk, Emergency Services 12700 Norwalk Boulevard, Norwalk, CA 90650 *www.ci.norwalk.ca.us/publicsafety.asp*
	City of San Francisco, Earthquake Safety Implementation Program 1 Dr. Carlton B. Goodlett Place, Room 362, San Francisco, CA 94102 *www.sfgsa.org/index.aspx?page=6044*
	Clark County Building Department 4701 W. Russell Rd., Las Vegas, NV 89118-2231 *www.clarkcountynv.gov/depts/development_services*
Non-Profit	Applied Technology Council 201 Redwood Shores Parkway, Ste 240, Redwood City, CA 94065 *www.atcouncil.org*
	Cascadia Hazards Institute 400 E. University Way, Ellensburg, WA 98926 *http://www.cascadiahazards.org/*
	Earthquake Engineering Research Institute (EERI) 499 14th Street, Suite 220, Oakland, CA 94612-1934 *www.eeri.org*
	ICC-Evaluation Services 3060 Saturn Street, Suite 100, Brea, California 92821 *http://www.icc-es.org/*
Individual	Dominic Sims, International Code Council

SECTION B

Financial

Subsection B1

Explanation of Financial Documents

Explanation of Financial Documents

1. WSSPC Independent Accountant's Review and Financial Statements Report

The financial statements were prepared by an accountant for the WSSPC Fiscal Year ending November 30, resulting in a net increase of $3,117 (page 3). This differs slightly from the Quickbooks Net Income (see Item 2) due to rounding.

WSSPC had 13 Affiliate members in FY 13-14 who contributed $4475, an increase of $300 from FY 12-13. Affiliate members help to offset expenses not covered by the FEMA cooperative agreements.

2. WSSPC FY 2013-2014 Income and Expense

This document shows how income and expenses were proportioned among the FEMA cooperative agreements during the fiscal year and how WSSPC funds are entered into Quickbooks software, before allocating the expenses to tasks in the FEMA Work Plan. The left column records the totals.

A. **FEMA Grant 2012** August 1, 2012 – July 31, 2013, MOD001 August 1, 2013 – December 31, 2013

Expenses included in the FEMA 2012 column are those incurred in the last month of the cooperative agreement extension (December 2013). (A no-cost extension was granted until December 31, 2013 to allow California, Guam, and Hawaii to utilize all of the state assistance funding allocated to them through WSSPC).

B. **FEMA Grant 2013** August 1, 2013 – July 31, 2014

The FEMA Grant 2013 time period reflected in this column is from December 1, 2013 until it closed July 31, 2014. Total amount of the agreement for this year was $250,000.00; the extra $25,000 was to provide travel support for WSSPC members to the National Earthquake Program Managers meeting and to conduct an Earthquake Early Warning training at that meeting.

C. **FEMA Grant 2014** August 1, 2014 – July 28, 2015

Expenses in the FEMA 2014 column are from August 1, 2014 to November 30, 2014. The funding is for $225,000 for WSSPC and $50,500 for state projects to be determined by FEMA.

D. **WSSPC**

The WSSPC column shows income and expenses not included or covered by the FEMA cooperative agreements. The salary number reflects changes in Paid Time Off (PTO).

3. **FEMA GRANT 2012**
   Income and Expenses of the entire cooperative agreement.

4. **FEMA Grant 2013**
   Income and Expenses of the entire cooperative agreement.

Subsection B2

Independent Accountant's Review Report and Financial Statements November 30, 2014 and 2013

COOK CPA Group

WESTERN STATES SEISMIC POLICY COUNCIL

INDEPENDENT ACCOUNTANT'S REVIEW REPORT
and
FINANCIAL STATEMENTS

NOVEMBER 30, 2014 AND 2013

CONTENTS

COOK CPA Group

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3007 Douglas Blvd., Suite 175
Roseville, California 95661

INDEPENDENT ACCOUNTANT'S REVIEW REPORT

Board of Directors
Western States Seismic Policy Council

We have reviewed the accompanying statements of financial position of Western States Seismic Policy Council as of November 30, 2014 and 2013, and the related statements of activities, cash flows and functional expenses for the years then ended. A review includes primarily applying analytical procedures to management's financial data and making inquiries of company management. A review is substantially less in scope than an audit, the objective of which is the expression of an opinion regarding the financial statements as a whole. Accordingly, we do not express such an opinion.

Management is responsible for the preparation and fair presentation of the financial statements in accordance with accounting principles generally accepted in the United States of America and for designing, implementing, and maintaining internal control relevant to the preparation and fair presentation of the financial statements.

Our responsibility is to conduct the reviews in accordance with Statements on Standards for Accounting and Review Services issued by the American Institute of Certified Public Accountants. Those standards require us to perform procedures to obtain limited assurance that there are no material modifications that should be made to the financial statements. We believe that the results of our procedures provide a reasonable basis for our report.

Based on our reviews, we are not aware of any material modifications that should be made to the accompanying financial statements in order for them to be in conformity with accounting principles generally accepted in the United States of America.

Cook CPA Group

Roseville, California
January 20, 2015

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF FINANCIAL POSITION
NOVEMBER 30, 2014 AND 2013

	2014	2013
Assets:		
Cash	$ 154,848	$ 146,332
Grants receivables (Note 2)	19,211	31,648
Books and periodicals	500	500
Office equipment at cost (Less accumulated depreciation of $7,035 and $6,767) (Note 3)	1,109	1,377
Total Assets	$ 175,668	$ 179,857
Liabilities:		
Accrued expenses and accounts payable	$ 2,708	$ 9,696
Accrued vacation	3,751	4,069
Total Liabilities	6,459	13,765
Net Assets:		
Unrestricted	169,209	166,092
Total Net Assets	169,209	166,092
Total Liabilities and Net Assets	$ 175,668	$ 179,857

See accompanying notes and independent accountant's review report.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF ACTIVITIES
FOR THE YEARS ENDED NOVEMBER 30, 2014 AND 2013

	Unrestricted	
	2014	**2013**
Revenues and Support:		
Membership dues and registration	$ 4,475	$ 4,175
FEMA cooperative agreements	232,199	246,165
Interest income	201	198
Total Revenues and Support	236,875	250,538
Expenses:		
Program services	197,123	209,588
Management and general	36,635	39,852
Total Expenses	233,758	249,440
Change in Net Assets	3,117	1,098
Net Assets at Beginning of Year	166,092	164,994
Net Assets at End of Year	$ 169,209	$ 166,092

See accompanying notes and independent accountant's review report.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENTS OF CASH FLOWS
FOR THE YEARS ENDED NOVEMBER 30, 2014 AND 2013

	2014	2013
RECONCILIATION OF NET INCOME FROM OPERATIONS TO NET CASH PROVIDED BY OPERATING ACTIVITIES:		
Change in net assets	$ 3,117	$ 1,098
Change in operating assets and liabilities:		
Depreciation	268	900
(Increase) Decrease in:		
Grants receivable	12,437	8,835
Increase (Decrease) in:		
Accounts payable	(6,988)	3,192
Accrued vacation	(318)	(943)
Cash provided by operating activities	8,516	13,082
NET INCREASE IN CASH	8,516	13,082
Cash, Beginning of the year	146,332	133,250
Cash, End of the year	$ 154,848	$ 146,332

See accompanying notes and independent accountant's review report.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENT OF FUNCTIONAL EXPENSES
YEAR ENDED NOVEMBER 30, 2014

	Program Services	Management and General	Total
Salaries and fringe benefits	$ 115,822	$ 21,468	$ 137,290
Payroll taxes	6,835	1,207	8,042
Professional fees - accounting	1,262	5,047	6,309
Professional fees - other	3,756	663	4,419
Rent	15,830	2,794	18,624
Insurance	772	257	1,029
Telephone	2,078	694	2,772
Office supplies and miscellaneous	2,733	911	3,644
Internet services	1,401	-	1,401
Staff expenses	5,445	-	5,445
Conference expenses	8,391	-	8,391
State assistance	22,822	-	22,822
Executive committee	9,209	1,024	10,233
Bank and payroll charges	767	2,302	3,069
Depreciation and amortization	-	268	268
Total Expenses	$ 197,123	$ 36,635	$ 233,758

See accompanying notes and independent accountant's review report.

WESTERN STATES SEISMIC POLICY COUNCIL
STATEMENT OF FUNCTIONAL EXPENSES
YEAR ENDED NOVEMBER 30, 2013

	Program Services	Management and General	Total
Salaries and fringe benefits	$ 124,914	$ 24,073	$ 148,987
Payroll taxes	7,271	1,284	8,555
Professional fees - accounting	1,269	5,076	6,345
Professional fees - other	4,029	711	4,740
Rent	15,830	2,794	18,624
Insurance	816	272	1,088
Telephone	2,190	731	2,921
Office supplies and miscellaneous	3,147	1,049	4,196
Internet services	1,145	-	1,145
Staff expenses	8,742	-	8,742
Conference expenses	5,060	-	5,060
State assistance	25,384	-	25,384
Executive committee	9,143	1,017	10,160
Bank and payroll charges	648	1,945	2,593
Depreciation and amortization	-	900	900
Total Expenses	$ 209,588	$ 39,852	$ 249,440

See accompanying notes and independent accountant's review report.

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

Description of Organization

The Western States Seismic Policy Council (the Council) was founded in 1979 and incorporated in 1996 as a 501 (c)(3) non-profit organization. The Council provides a forum to develop seismic policies and share information to promote programs to reduce earthquake losses throughout the western region of the United States, three U.S. territories, a Canadian territory, and a Canadian province. It is funded primarily by the Department of Homeland Security's Federal Emergency Management Agency (FEMA).

Basis of Accounting

The Council prepares its financial statements in accordance with accounting principles generally accepted in the United States of America, which involves the application of accrual accounting; consequently, revenue and support are recognized when earned, and expenses are recognized when incurred.

Financial Statement Presentation

Financial statement presents information regarding its financial position and activities according to three classes of net assets: unrestricted net assets, temporarily restricted net assets, and permanently restricted net assets. The Council has no temporarily and permanently restricted net assets during 2014 and 2013.

Allowance for Uncollectible Accounts

No allowance for uncollectible accounts has been provided since management considers all accounts to be collectible as the grants receivable have historically been received in full.

Estimates

The preparation of financial statements in conformity with accounting principles generally accepted in the United States of America requires management makes estimates and assumptions that affect the reported amounts of assets and liabilities and disclosure of contingent assets and liabilities at the date of the financial statements and the reported amounts of revenues and expenses during the reporting period. Actual results could differ from those estimates.

Cash and Cash Equivalents

For the purposes of reporting cash flows, the Council considers all unrestricted highly liquid investments with an initial maturity of three months or less to be cash equivalents.

NOTE 1 – SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CONTINUED)

Functional Allocation of Expenses

The costs of providing the Council's programs and supporting services have been summarized on a functional basis. Accordingly, certain costs have been allocated among the programs and supporting services.

Grants and Cooperative Agreements

The grants and cooperative agreements are cost reimbursement type agreements; therefore, the Council records income when expenditures are made in compliance with the terms of the agreements.

Income Taxes

The Council under preliminary determination is a not-for-profit organization that is exempt from income taxed under Section 501(c)(3) of the Internal Revenue Code and Section 23701(d) of the California Revenue and Taxation Code.

Property and Equipment

Property and equipment are recorded at cost when acquisition costs are greater than $5,000. Depreciation is provided on the straight-line basis over five years.

Subsequent Event

The Council has evaluated subsequent events for potential recognition and/or disclosure through January 20, 2015, the date the financial statements were issued.

NOTE 2 – GRANTS AND COOPERATIVE AGREEMENT RECEIVABLES

The Council has a receivable from FEMA in the following amounts as of November 30:

	2014	2013
FEMA	$ 19,211	$ 31,648
	$ 19,211	$ 31,648

NOTE 3 – OFFICE EQUIPMENT

Property and equipment consist of the following as of November 30:

	2014	2013
Computer equipment	$ 3,321	$ 3,321
Office equipment	4,823	4,823
Total	8,144	8,144
Less accumulated depreciation	(7,035)	(6,767)
Capital assets, net	$ 1,109	$ 1,377

Depreciation expense for the year ending November 30, 2014 and 2013 totaled $268 and $900, respectively.

NOTE 4 – FEMA REVENUE

FEMA revenue consists of the following for the year ended November 30:

	2014	2013
2012 FEMA	$ 4,707	$ 175,549
2013 FEMA	172,229	70,616
2014 FEMA	55,263	-
Total	$ 232,199	$ 246,165

NOTE 5 – LEASE AGREEMENT

The Council leases office space in Sacramento, California on a month to month lease, in arrears, in the amount of $1,552.

NOTE 6 – DEFINED CONTRIBUTION PLAN

The Council sponsors a defined contribution plan (a SIMPLE IRA plan) covering regular employees who meet certain eligibility requirements. The Council matches an employee's contribution dollar for dollar up to 3% per year. Employees who qualify under Internal Revenue Service rules may make catch up contributions to this plan. The contributions made during the years ended November 30, 2014 and 2013 were $2,460 and $2,563, respectively.

NOTE 7 – COMMITMENTS AND CONTINGENCIES

The Council received a grant from FEMA for an amount of $275,500 for the time period from August 1, 2014 to July 28, 2015. The Council received a grant from FEMA for an amount of $250,000 for the time period from August 1, 2013 to July 31, 2014. As of November 30, 2014, there was a total of $220,237 remaining to be used by the Council for performance of various services in accordance with the terms of the grant.

Subsection B3

FY 13-14 Income and Expenses
December 2013 through November 2014

Western States Seismic Policy Council
FY 13-14 Income and Expense
December 2013 through November 2014

Accrual Basis	Dec 2013 - Nov 2014 TOTALS	FEMA 2012	FEMA 2013	FEMA 2014	WSSPC
Income					
401.0 · Interest Inc					
401.1 · Money Mkt Interest Income	183.84	0.00	0.00	0.00	183.84
401.2 · CD Interest Income	16.98	0.00	0.00	0.00	16.98
Total 401.0 · Interest Inc	200.82	0.00	0.00	0.00	200.82
410.0 · Membership Dues	4,475.00	0.00	0.00	0.00	4,475.00
450.0 · Grants Earned					
460.0 · FEMA Grants Earned					
460.10 · 2014 FEMA Grants Earned	55,262.93	0.00	0.00	55,262.93	0.00
460.8 · 2012 FEMA Grants Earned	4,707.08	4,707.08	0.00	0.00	0.00
460.9 · 2013 FEMA Grants Earned	172,228.91	0.00	172,228.91	0.00	0.00
Total 460.0 · FEMA Grants Earned	232,198.92	4,707.08	172,228.91	55,262.93	0.00
Total 450.0 · Grants Earned	232,198.92	4,707.08	172,228.91	55,262.93	0.00
Total Income	236,874.74	4,707.08	172,228.91	55,262.93	4,675.82
Expense					
500.0 · P/R Expenses					
500.1 · Salary	104,906.48	501.85	73,152.83	31,570.39	-318.59
500.2 · Benefits					
500.7 · Employer IRA Contribution					
500.701 · Employer IRA Contrib-forSutch	2,460.48	0.00	1,640.32	820.16	0.00
500.7 · Employer IRA Contribution - Other	0.00	0.00	0.00	0.00	0.00
Total 500.7 · Employer IRA Contribution	2,460.48	0.00	1,640.32	820.16	0.00
500.2 · Benefits - Other	28,828.66	0.00	22,383.27	6,445.39	0.00
Total 500.2 · Benefits	31,289.14	0.00	24,023.59	7,265.55	0.00
500.3 · Employer Contrib/Taxes	8,041.59	0.00	5,718.34	2,323.25	0.00
500.4 · Workers' Comp	1,094.48	0.00	827.34	267.14	0.00
500.5 · Payroll Service	2,820.98	0.00	1,744.03	1,076.95	0.00
Total 500.0 · P/R Expenses	148,152.67	501.85	105,466.13	42,503.28	-318.59
506.0 · Prof Fees Accounting	6,309.13	0.00	6,086.00	223.13	0.00
507.0 · Prof Fees Consulting	4,643.75	0.00	4,105.00	538.75	0.00
510.0 · Office Supplies	2,963.79	0.00	2,077.31	886.48	0.00
515.0 · Telephone	2,771.50	0.00	1,945.00	826.50	0.00
522.0 · Postage and Delivery	218.43	0.00	218.43	0.00	0.00
525.0 · Internet Services	1,400.38	0.00	793.88	606.50	0.00

Western States Seismic Policy Council
FY 13-14 Income and Expense
December 2013 through November 2014

	Dec 2013 - Nov 2014	FEMA 2012	FEMA 2013	FEMA 2014	WSSPC
530.0 · Staff Expenses					
530.1 · Staff Meals	466.16	0.00	0.00	0.00	466.16
530.2 · Staff Mileage	232.46	0.00	195.50	36.96	0.00
530.3 · Staff Transportation	1,224.26	0.00	1,116.01	108.25	0.00
530.4 · Staff Hotel	2,558.20	0.00	1,984.96	573.24	0.00
530.6 · Staff Meetings	965.00	0.00	890.00	75.00	0.00
Total 530.0 · Staff Expenses	5,446.08	0.00	4,186.47	793.45	466.16
535.0 · Executive Committee Expense					
535.1 · Meals Exec Comm	1,152.61	0.00	0.00	0.00	1,152.61
535.2 · Mileage Exec Comm	1,127.84	0.00	43.68	1,084.16	0.00
535.3 · Transportation Exec Comm	3,836.23	0.00	3,125.86	710.37	0.00
535.4 · Hotel Exec Comm	3,116.82	0.00	2,106.72	1,010.10	0.00
535.5 · Meetings Exec Comm	1,000.00	0.00	1,000.00	0.00	0.00
Total 535.0 · Executive Committee Expense	10,233.50	0.00	6,276.26	2,804.63	1,152.61
550.0 · Workshops					
550.2 · EQ Program Managers Meeting	16,846.98	0.00	16,846.98	0.00	0.00
550.5 · State Assistance-CA	5,586.29	4,205.23	0.00	1,381.06	0.00
550.6 · State Assistance-GU	0.00	0.00	0.00	0.00	0.00
550.7 · EEW	388.91	0.00	388.91	0.00	0.00
Total 550.0 · Workshops	22,822.18	4,205.23	17,235.89	1,381.06	0.00
554.0 · Conferences					
554.7 · 2014 Annual Conference	8,388.64	0.00	8,113.14	0.00	275.50
Total 554.0 · Conferences	8,388.64	0.00	8,113.14	0.00	275.50
570.0 · Insurance					
570.1 · Liability Insurance	1,054.00	0.00	1,054.00	0.00	0.00
570.3 · Insurance Other	-24.73	0.00	272.00	0.00	-296.73
Total 570.0 · Insurance	1,029.27	0.00	1,326.00	0.00	-296.73
575.0 · Rent	18,624.00	0.00	13,968.00	4,656.00	0.00
580.0 · Bank Service Charges	248.12	0.00	237.80	0.00	10.32
581.0 · Equipment Rental					
581.3 · Postage meter	131.75	0.00	88.60	43.15	0.00
Total 581.0 · Equipment Rental	131.75	0.00	88.60	43.15	0.00
583.0 · Miscellaneous Expenses	0.00	0.00	0.00	0.00	0.00
591.0 · Licenses and Permits	105.00	0.00	105.00	0.00	0.00
595.0 · Depreciation Expense	268.00	0.00	0.00	0.00	268.00
Total Expense	233,756.19	4,707.08	172,228.91	55,262.93	1,557.27
NET INCOME	**3,118.55**	**0.00**	**0.00**	**0.00**	**3,118.55**

Subsection B4

FEMA Grant 2012
August 2012 through December 2013

Western States Seismic Policy Council
FEMA Grant 2012
August 2012 through December 2013

	Aug '12 - Dec 13
Income	
450.0 · Grants Earned	
460.0 · FEMA Grants Earned	
460.8 · 2012 FEMA Grants Earned	250,000.00
Total 460.0 · FEMA Grants Earned	250,000.00
Total 450.0 · Grants Earned	250,000.00
Total Income	250,000.00
Expense	
500.0 · P/R Expenses	
500.1 · Salary	114,286.01
500.2 · Benefits	
500.7 · Employer IRA Contribution	
500.701 · Employer IRA Contrib-forSutch	2,460.48
500.7 · Employer IRA Contribution - Other	0.00
Total 500.7 · Employer IRA Contribution	2,460.48
500.2 · Benefits - Other	29,990.32
Total 500.2 · Benefits	32,450.80
500.3 · Employer Contrib/Taxes	8,794.03
500.4 · Workers' Comp	971.08
500.5 · Payroll Service	2,317.18
Total 500.0 · P/R Expenses	158,819.10
506.0 · Prof Fees Accounting	6,345.00
507.0 · Prof Fees Consulting	380.00
510.0 · Office Supplies	3,117.69
515.0 · Telephone	2,895.43
520.0 · Printing	1,282.18
522.0 · Postage and Delivery	369.62
525.0 · Internet Services	1,133.23
530.0 · Staff Expenses	
530.2 · Staff Mileage	127.64
530.3 · Staff Transportation	3,885.04
530.4 · Staff Hotel	3,313.79
530.6 · Staff Meetings	2,100.00
Total 530.0 · Staff Expenses	9,426.47

Western States Seismic Policy Council
FEMA Grant 2012
August 2012 through December 2013

	Aug '12 - Dec 13
535.0 · Executive Committee Expense	
535.2 · Mileage Exec Comm	69.31
535.3 · Transportation Exec Comm	3,447.25
535.4 · Hotel Exec Comm	2,761.50
Total 535.0 · Executive Committee Expense	6,278.06
550.0 · Workshops/Training	
550.4 · State Assistance-HI	13,547.90
550.5 · State Assistance-CA	12,131.45
550.6 · State Assistance-GU	8,997.45
Total 550.0 · Workshops	34,676.80
554.0 · Conferences	
554.6 · 2013 Annual Conference	4,708.82
Total 554.0 · Conferences	4,708.82
570.0 · Insurance	
570.1 · Liability Insurance	1,054.00
570.3 · Insurance Other	268.00
Total 570.0 · Insurance	1,322.00
575.0 · Rent	18,624.00
580.0 · Bank Service Charges	426.90
581.0 · Equipment Rental	
581.3 · Postage meter	130.65
Total 581.0 · Equipment Rental	130.65
590.0 · Property Taxes	4.05
591.0 · Licenses and Permits	60.00
Total Expense	250,000.00

Subsection B4

FEMA Grant 2013
August 2013 through July 2014

Accrual Basis

Western States Seismic Policy Council
FEMA Grant 2013
August 2013 through July 2014

	Aug '13 - Jul 14
Income	
450.0 · Grants Earned	
460.0 · FEMA Grants Earned	
460.9 · 2013 FEMA Grants Earned	242,845.35
Total 460.0 · FEMA Grants Earned	242,845.35
Total 450.0 · Grants Earned	242,845.35
Total Income	242,845.35
Expense	
500.0 · P/R Expenses	
500.1 · Salary	110,008.03
500.2 · Benefits	
500.7 · Employer IRA Contribution	
500.701 · Employer IRA Contrib-forSutch	2,563.00
500.7 · Employer IRA Contribution - Other	0.00
Total 500.7 · Employer IRA Contribution	2,563.00
500.2 · Benefits - Other	34,044.31
Total 500.2 · Benefits	36,607.31
500.3 · Employer Contrib/Taxes	8,372.41
500.4 · Workers' Comp	1,146.20
500.5 · Payroll Service	2,436.51
Total 500.0 · P/R Expenses	158,570.46
506.0 · Prof Fees Accounting	6,086.00
507.0 · Prof Fees Consulting	8,845.00
510.0 · Office Supplies	2,874.41
515.0 · Telephone	2,912.98
522.0 · Postage and Delivery	318.43
525.0 · Internet Services	1,134.88
530.0 · Staff Expenses	
530.2 · Staff Mileage	207.37
530.3 · Staff Transportation	1,130.01
530.4 · Staff Hotel	1,984.96
530.6 · Staff Meetings	930.00
Total 530.0 · Staff Expenses	4,252.34
535.0 · Executive Committee Expense	
535.2 · Mileage Exec Comm	68.54
535.3 · Transportation Exec Comm	6,250.13
535.4 · Hotel Exec Comm	3,199.85

Accrual Basis

Western States Seismic Policy Council
FEMA Grant 2013
August 2013 through July 2014

	Aug '13 - Jul 14
535.5 · Meetings Exec Comm	1,000.00
Total 535.0 · Executive Committee Expense	10,518.52
550.0 · Workshops	
550.2 · EQ Program Managers Meeting	16,846.98
550.7 · EEW	388.91
Total 550.0 · Workshops	17,235.89
554.0 · Conferences	
554.7 · 2014 Annual Conference	8,113.14
Total 554.0 · Conferences	8,113.14
570.0 · Insurance	
570.1 · Liability Insurance	1,054.00
570.3 · Insurance Other	272.00
Total 570.0 · Insurance	1,326.00
575.0 · Rent	20,176.00
580.0 · Bank Service Charges	244.70
581.0 · Equipment Rental	
581.3 · Postage meter	131.60
Total 581.0 · Equipment Rental	131.60
591.0 · Licenses and Permits	105.00
Total Expense	242,845.35

Total Awarded	250,000.00
WSSPC Amount	225,000.00
State Assistance Amount	25,000.00
Total Expended	242,845.35
WSSPC Expenses	223,316.76
State Assistance Expenses	19,528.59
Total Remaining Unspent	7,154.65
WSSPC	1,683.24
State Assistance	5,471.41

SECTION C

Activities

ANNUAL MEETING

WSSPC holds an annual meeting to review proposed earthquake and tsunami risk reduction policies, and provide additional networking and educational opportunities for its members and affiliates. The 2014 meeting was held in conjunction with the 50th Anniversary Conference of the Great Alaska Earthquake and Tsunami of 1964 in Anchorage, Alaska July 21, 2014.

Site of the 2014 WSSPC Annual Meeting at the BP Energy Center, Anchorage, Alaska.

Image: http://www.bp.com/en_us/bp-us/where-we-operate/bp-in-alaska/bp-energy-center.html

A hired bus picked up attendees at each of the three conference hotels and took us offsite to the BP Energy Center, a venue provided free to non-profit organizations. The tranquil setting (above) set the stage for a productive day's worth of meetings. The event kicked off with WSSPC's three policy committees which met to review policies and discuss new business. Participation was increased due to having conferencing capability in each of the committee rooms allowing those not attending to call in. Following these committee meetings, the WSSPC Board of Directors met to discuss officer nominations, policy recommendations and new business.

The Awards Luncheon to recognize the Lifetime Achievement and Awards in Excellence winners was hosted by John Madden, WSSPC Board Vice President and Director of the Alaska Division of Homeland Security and Emergency Management. Rich Koehler of the Alaska Division of Geological and Geophysical Surveys presented his seismic research in remote parts of Alaska.

The Annual Business Meeting followed the Luncheon and included representation from 23 members. The members elected the biennial Board of Directors; heard committee reports; and adopted 5 policy recommendations relating to earthquake and tsunami risk reduction.

WSSPC AWARDS PROGRAM

WSSPC implemented an awards program to support its mission to develop seismic policies and share information to promote programs intended to reduce earthquake-related losses. Since 1996, WSSPC awards have been effective in recognizing the hard-working, creative and innovative efforts of those within the earthquake hazards reduction community, brought greater visibility to exemplary programs, projects and products, and facilitated the transfer of successful experiences to other agencies.

- Awards in Excellence are awarded annually to honor exemplary programs, projects, and products that have significantly contributed to addressing earthquake risk reduction through demonstrated achievements in earthquake mitigation, preparedness, response and recovery. One award is selected to receive the Overall Award in Excellence.
- The National Awards in Excellence are awarded every four years in partnership with the Northeast States Emergency Consortium (NESEC), the Central U.S. Earthquake Consortium (CUSEC), and the Cascadia Region Earthquake Workgroup (CREW). These awards recognize persons, organizations and agencies in acknowledgement of their achievements, leadership and dedication in earthquake hazards reduction as demonstrated through exemplary programs, projects, and products that address earthquake risk reduction with the United States.
- Lifetime Achievement Awards are awarded periodically to honor outstanding leaders who are currently practicing, and who have demonstrated an extraordinary commitment, level of service, and contribution to earthquake risk reduction throughout their careers.
- WSSPC Leadership Awards are awarded periodically to honor individuals within the WSSPC membership who have demonstrated sustained leadership benefitting the WSSPC community.

This year's award ceremony was held in conjunction with the 50th Anniversary Conference of the Great Alaska Earthquake and Tsunami of 1964 in Anchorage, Alaska. There were 5 Awards in Excellence winners, and 2 Lifetime Achievement award winner. The winning nominations are highlighted on the following pages.

2014 Lifetime Achievement Award

Hawaii's Gary Chock, S.E. received a Lifetime Achievement Award in Earthquake Risk Reduction. He has a multiple-decades long history of dedicated public service to the State of Hawaii in the areas of earthquake and tsunami mitigation. His contributions have assisted earthquake risk reduction in both the private and public sectors.

As President of Martin & Chock, Inc., Mr. Chock has been the principal investigator for the firm's research work on multi-hazard analysis and planning, with emphasis on use of GIS analysis, building damage, and building performance studies. His work has involved tsunami, earthquake and hurricane hazard research, building risk assessments, hazard mitigation planning, coastal flooding hazards, building code development, and emergency response planning. For the past 3 years, Mr. Chock also has served as chairman of the newly formed American Society of Civil Engineers (ASCE) committee on Tsunami Loads and Effects, which has just completed a formal draft of a new chapter on Tsunami Loads and Effects (TLE) for inclusion in the 2016 version of the ASCE7 standard on building design loads. The TLE chapter presents comprehensive design provisions for Probabilistic Tsunami Hazard Assessment and Performance Based Tsunami Design of coastal buildings and other structures for tsunami loading and scour; if approved and incorporated into the standard, it will then become part of the 2018 International Building Code, which will form the basis for all building codes in the United States. Not only will the standard lead to significant improvements in the performance of critical facilities and larger buildings in tsunami inundation zones, it also will serve to improve the resilience and recovery of coastal communities in these states after a damaging tsunami.

Mr. Chock is a charter member of the Hawaii State Earthquake Advisory Committee (HSEAC), which was established in 1990 under the auspices of the State of Hawaii's Department of Defense, Hawaii State Civil Defense Agency, and which serves as Hawaii's seismic council. HSEAC is comprised of volunteer members whose areas of expertise include earthquake science, engineering, hazard mitigation, planning, and emergency management. Mr. Chock has maintained 23 years of continuous service with HSEAC, and served as its chairperson during the committee's first seven years, guiding it through its formative period. He also functioned as Team Leader for the 2011 Japan and 2010 Chile tsunamis reconnaissance teams, which provided valuable post-tsunami engineering and building information to help mitigate future risks.

In addition to the previously mentioned activities, Mr. Chock has volunteered for many other earthquake/tsunami risk reduction committees and projects over the years, including: the Applied Technology Council Project 79-1 Update of FEMA P646, *Guidelines for Designs of Structures for Vertical Evacuation from Tsunamis*; service on the Oversight Committee for the National Institute of Building Sciences, Development of a Tsunami Risk Assessment Model for HAZUS-MH; the *Multi-Hazard Pre-Disaster Mitigation Plan* for the City and County of Honolulu; Development of Performance-Based Tsunami Engineering (Co-Principal Investigator); *Structural Risk and Vulnerability Assessment of State of Hawaii Critical Facilities*; *University of Hawaii Systemwide Hazard Mitigation Plan*; *Investigation of Post and Pier Earthquake Damage and Development of Incremental Retrofits for Hawaii Single-Family Residences*; and Hawaii Building Database Integration for Honolulu, Maui, and Hawaii Counties. In addition to his activities with the ASCE, Mr. Chock has had professional affiliations with the Earthquake Engineering Research Institute, the National Institute of Building Sciences Building Seismic Safety Council, and the International Building Code Structural Committee. He also developed the Emergency Operations Plans for the City of Honolulu, and the counties of Maui and Kauai.

2014 Lifetime Achievement Award

Nevada's Ron Lynn received a Lifetime Achievement Award in Earthquake Risk Reduction. He has been a champion of earthquake safety throughout his career. Educated as a geologist at the University of Nevada at Las Vegas, his professional endeavors have followed a path that has kept him continually trumpeting the cause of earthquake safety. Participating in the development of codes and standards for over 30 years – many directly impacting the seismic resilience of buildings and structures using the Uniform and International Building Codes – Mr. Lynn was one of the first to submit code language addressing soils/building interaction, leading to an awareness within the code that soils are a critical component for the performance of buildings in an earthquake. His ability to collaborate with scientists, engineers, building owners, businesses, and the public have enabled a more efficient dissemination of seismic standards in our communities.

Mr. Lynn has been with the Clark County Department of Development Services since 1981. As Director of the Department of Building & Fire Prevention Bureau, he was one of the first local government jurisdictions to join as an affiliate member of WSSPC. He has been a member of the WSSPC Engineering, Construction and Building Codes Committee since 1999, and currently serves as committee chair. In 2002, his department was recognized with an Award in Excellence for mitigation efforts for the Mitigation of Fault Related Hazards – shared with the Nevada Bureau of Mines and Geology (NBMG) – for implementing regulations that established "special geotechnical consideration areas" within 2,000 feet of NBMG mapped faults, and required setbacks from faults. Most recently, his department was one of the first government entities in the State of Nevada to support the Great Nevada Shake Out by providing training as well as public service announcements to stimulate participation in seismic safety awareness.

Mr. Lynn has lectured in New Zealand, Australia, Mexico and Canada – as well as throughout the United States – on the importance of securing the built environment from natural and manmade disasters. His knowledge and professionalism has helped bring success in the passage of important legislation on seismic issues for statewide benefits, and his involvement with the Nevada Organization of Building Officials allowed him a platform to promote earthquake code changes to those charged with implication and management of building codes throughout Nevada. He has received numerous awards and wide recognition for his work, including: the Ronald H. Brown Award by the U.S. Planning Committee of World Standards Day; the Associated General Contractors 2002 Government Person of the Year; recognition in 2009 by the U.S. Congress for his contributions in building safety; the 2009 Superior Technical Achievement Award from Fiatech; a 2010 Senatorial Commendation for his commitment to building safety, energy conservation, and emergency response; and a proclamation by the Governor of Nevada declaring December 9, 2010, as Ronald L. Lynn Day.

Mr. Lynn has served on a variety of local, state and national committees during his career: he is past President of the International Code Council; past member of the Board of Directors of the International Accreditation Service; first Chairman of the Board of International Professional Standards for ICC; past chair of the ICBO Special Inspections Committee and Immediate Past Chairman of the Nevada Organization of Building Officials. He is currently Chairman for the Nevada Earthquake Safety Council and the ICC Major Jurisdictions Committee; a member of the National Institute of Building Sciences Building Seismic Safety Council's Board of Direction, the National Earthquake Hazards Reduction Program's Advisory Committee on Earthquake Hazards Reduction, the Nevada State Hazard Mitigation Planning Steering Committee, and the Nevada Bureau of Mines and Geology Advisory Committee.

Overall Award in Excellence for Multijurisdictional Planning

Administering Agency:	Washington State Military Department, Emergency Management Division; United States Geological Survey – PNW Team; Federal Emergency Management Agency – Regions 8 & 10, Washington State Department of Natural Resources, Geology and Earth Sciences; Western Washington University- Resilience Institute, URS Corporation.
Program/Project Name:	*Washington State Earthquake Scenario Catalog*
Contact:	John Schelling, WA EMD Earthquake Program Manager
Address:	Building 20, Camp Murray, WA 98430
Email:	john.schelling@mil.wa.gov

Program Summary

The *Washington State Earthquake Scenario Catalog* (WSESC) is a new web-based tool using GIS, HAZUS, and social vulnerability and economic indicators to enable emergency managers to better understand what the particular impacts are from 20 different earthquake scenarios. Prior to the development of the WSESC, much of the relevant and available literature regarding earthquakes was heavily focused on documenting and characterizing the seismic hazards that exist throughout Washington State, but seemed to fall short on details of what matters most to emergency managers – what and why. Because scenarios are helpful tools that enable responders to envision potential impacts (WSSPC advocated for their usefulness in *Policy 12-1 Earthquake Planning Scenarios*), Washington State Emergency Management (EMD), along with experts from the Washington Department of Natural Resources (DNR), the Federal Emergency Management Agency (FEMA), and the U.S. Geological Survey (USGS), developed the scenario catalog, which provides credible, consistent, authoritative, and up-to-date information for mitigation planning; response planning; exercises and training; and earthquake response. To ensure the resulting product would meet the needs of its intended users, Western Washington University's Resilience Institute engaged focus groups with local emergency management organizations to collect feedback on how they wanted to interact with the data, what data should be shown and how it should look.

WSESC is the first of its kind, a powerful tool that blends USGS calculated ground motions with FEMA's HAZUS loss estimation modeling software and USGS' social vulnerability and community economic indicators to create an online GIS tool that lets users customize the information in a way that is relevant to them, and in a way that non-technical users can visualize and easily understand. Future plans include the incorporation of additional hazards, such as tsunamis and volcanoes. Meanwhile, WSESC's value has already been established – it is being used to help develop the Cascadia Region Response Plan, and the Pacific Northwest Economic Region used it to create scenarios for a regional port exercise focused on long-term earthquake recovery.

More information can be found: *https://fortress.wa.gov/dnr/seismicscenarios/*

Award in Excellence for Non-Profit Agency Efforts

Administering Agency:	International Code Council Evaluation Service (ICC-ES)
Program/Project Name:	ICC-ES Evaluation Reports Program
Contact:	Shahin Moinian, P.E.
Address:	5360 Workman Mill Road, Whittier, CA 90601
Email:	smoinian@icc-es.org

Program Summary

The International Code Council Evaluation Service (ICC-ES) Evaluation Reports Program is a valuable tool for those involved in the development process to find safe and effective seismic materials and designs to help assure the safety of the inhabitants of modern buildings and the continuity of our communities. The service permits for the ongoing evolution of products and designs outside the traditional and time-consuming inclusion within the body of the building code, and provides regulators with an internationally accepted method to verify submittal compliance with the intent of the code. The resulting Evaluation Reports (ER) are accepted in virtually every juris diction in the United States including local, state, and federal governments.

New materials, products and methods of design are constantly being developed, and are often outside the scope of many design professionals, who have neither the time nor the expertise to fully evaluate new concepts for compliance with the intent of the code. The traditional and conservative approach is to deny new methods, designs or materials that are not described prescriptively within the body of the code. Although perceived as being the safe option, the reality is that by failing to keep up with the state-of-the-art of technology, buildings would be less safe and some structures could never be developed. This program establishes a process that allows design methods and materials to be evaluated on a critical and independent basis by teams of private and public engineers, who develop acceptance criteria (AC) for innovative products not specifically covered by the codes. The AC are debated in public, refined, and then established as the protocol for the evaluation of similar products and processes. Engineers who make use of ER are assured that innovative products, materials or designs have met applicable requirements; code officials can be assured their communities are protected at the highest possible level.

Maintaining a committee of volunteer experts can be challenging for any organization, but because of the strength of the ICC membership, ICC-ES manages to attract a variety of experts in the built environment on regular basis in order to assure the approved AC remain at the highest quality.

More information can be found at: *www.icc-es.org*

Award in Excellence for Research Projects

Administering Agency:	University of California San Diego Department of Structural Engineering
Program/Project Name:	*Performance of Hospital Components in Earthquakes and Fires*
Contact:	Professor Tara Hutchinson
Address:	9500 Gilman Dr. MC 0085, La Jolla, CA 92093-0085
Email:	tara@ucsd.edu

Program Summary

This research program is the first time a full-scale test building was subjected to both earthquakes and fires. The issue is that current building codes and standards for fire resistance assume that buildings are undamaged when fires start, yet many fire resistive features of new construction are not necessarily earthquake-resistant.

The project involved subjecting a five story concrete building with components that are common in hospitals to earthquake shaking followed by fires to evaluate how shaking-related damage compromises fire resistance. The building was initially supported on seismic isolators and experienced insignificant, repairable damage in a sequence of motions generated by the world's first and largest U.S. outdoor shake table. The building was subsequently fixed to the table and damaged in a sequence of motion to near collapse. Controlled fires were then set to study the impact of the loss of compartmentalization induced by the prior seismic motion sequence on the spread of smoke, temperature and fire. Several media events were held in April and May 2012 and tests were completed in May 2012. The international media exposure generated by these tests has demonstrated the project's relevance.

Extensive documentation using video cameras, more than 500 analog sensors and a GPS system has provided researchers, regulators and practicing engineers many insights into the tolerances and degradation of common building systems responding to movements during a range of earthquakes. Two 30 minute videos summarized the research and provided key outreach and informational tools to the public, regulators and policymakers. The final video was completed in October 2012, titled "Building it Better: Earthquake Resilient Hospitals for the Future" and is available at: http://uctv.tv/shows/Building-it-Better-Earthquake-Resilient-Hospitals-for-the-Future-21399. The $5 million in funding for the project came from a number of sources, including the National Science Foundation, the Network for Earthquake Engineering Simulation, California's Alfred E. Alquist Seismic Safety Commission, the Charles Pankow Foundation, plus broad stakeholder in-kind donations and participation from industry and government.

Although proposals for improving regulations are pending the completion of the data evaluations and computer simulations, preliminary presentations to relevant standards-development organizations have already begun. Ultimately, the benefits to society will be the enhancement of earthquake safety and reduction in earthquake-induced direct losses from shaking as well as indirect losses from fires through improvements in awareness, design and regulatory practices.

More information is available at: *http://bncs.ucsd.edu/*

Award in Excellence for Response Plans/Materials

Administering Agency:	Washington Department of Natural Resources, Division of Geology and Earth Resources
Program/Project Name:	*DGER Report of Investigations 36: Landslide and Liquefaction Maps for Aberdeen, Cosmopolis, and Hoquiam, Grays Harbor County, Washington: Effects on Tsunami Inundation Zones of a Cascadia Subduction Zone Earthquake*
Contact:	Stephen L. Slaughter, Hazards Geologist
Address:	1111 Washington ST SE, MS 47007, Olympia WA 98504-7007
Email:	stephen.slaughter@dnr.wa.gov

Program Summary

Although tsunami inundation zones have been modeled and evacuation routes planned in previous publications from the Washington Department of Natural Resources, Division of Geology and Earth Resources (DGER), there had been no detailed evaluations of soil initiation of liquefaction or detailed evaluations of seismically induced landslide risk for evacuation routes in coastal communities.

Earthquake-induced ground failures could adversely affect tsunami evacuation by blocking or damaging evacuation routes, potentially rendering them impassable, or impeding an efficient and rapid evacuation. The purpose of this project was to evaluate the suitability of existing tsunami evacuation routes and assembly areas for potential vulnerability to ground failure (liquefaction and shallow landslide) from a M9+ Cascadia Subduction Zone (CSZ) earthquake on specific areas within Grays Harbor County.

DGER has concentrated part of their technical program on earthquake-induced ground failures in order to improve evacuation planning for tsunamis that would inundate coastal areas in less than an hour after earthquake ground shaking. The combination of modeled ground failures with existing tsunami evacuation routes is the first of its kind in Washington State. DGER calculated critical acceleration of slopes and compared the data to estimated PGA values to identify shallow landslide hazards. The intent of this project was to visually communicate the potential seismically-induced ground failures to non-geologist; for officials who do not understand that the evacuation routes may likely be impassable to vehicular travel, the products further convey the need for alternative escape routes, especially walking. As a result of the report, some evacuation routes have already been modified, and there may be additional additions, removals, or other modifications to current evacuation routes and assembly areas.

The report can be found at: *http://www.dnr.wa.gov/Publications/ger_ri36_aberdeen_liquefaction.zip*

Award in Excellence for Educational Outreach

Administering Agency:	California Earthquake Authority
Program/Project Name:	Public Education, Mitigation, and Research Activities of the CEA
Contact:	Chris Nance
Address:	801 K Street Suite 1000, Sacramento CA 95814
Email:	cnance@calquake.com

Program Summary:
The California Legislature established the California Earthquake Authority (CEA) as a publicly managed, largely privately funded entity in 1996. In 2011, the California Residential Mitigation Program (CRMP) was created through a Joint Exercise of Powers Agreement between the California Office of Emergency Services and CEA. CEA has worked tirelessly to promote and support long-term community resilience by providing risk education, loss mitigation and insurance protection to help Californians prepare for and recover from damaging earthquakes. Accomplishments in the last several years include:

- Implementation of a year-round marketing program to reverse previous cyclical downturns in policy sales by highlighting CEA's value proposition—The Strength to Rebuild® -- using a standardized value-based preparedness message that combines "what to do" with "why to do it".
- Joining forces with the American Red Cross (Red Cross) to help more people prepare to survive and recover from California's next damaging earthquake by combining Red Cross expertise on preparing a kit, making a family disaster plan, and being informed, with the CEA's residential earthquake insurance expertise and loss-mitigation knowledge. As a result of Joined Forces, $340,000 was raised over 2 years to benefit Red Cross preparedness and response programs through a unique online auction, and a statewide tour of the Traveling Red Table™ was launched to promote participation in The Great California ShakeOut™ earthquake drill.
- Sponsoring the NGA-West2 project (NGA Next Generation Attenuation) and the UCERF3 (Uniform California Earthquake Rupture Forecast Version 3) model to: develop and use the best science to make earthquake insurance rates; and update the National Seismic Hazard Maps, which are used for the seismic design of buildings having an impact on almost all new building construction in California.
- Implementation of a pilot seismic retrofit program – Earthquake Brace + Bolt (EBB) – to provide up to $3,000 in rebates to participating homeowners in two specific locations in the state, with plans to expand statewide in the future.
- Following the passage of the first statewide building code for existing structures, and in coordination with FEMA, taking the lead on a project to develop prestandards, with a goal of acceptance as standards, and eventual adoption into building codes.

- Funding research to conduct detailed numerical, component, and shake table analysis of non-retrofit and retrofit elements to develop data to be used in calculating and determining insurance discounts.
- The creation of the position of Chief Mitigation Officer (CMO), which has done much to draw focus and push the topic of mitigation to the forefront. The CMO works to build relationships and network with stakeholders in local and state governing agencies, regulatory agencies, the engineering and research communities, and specialists in earthquake mitigation, to gain their input and their buy-in to the goals of the CEA Mitigation and CRMP programs efforts.

Additional information can be found at:

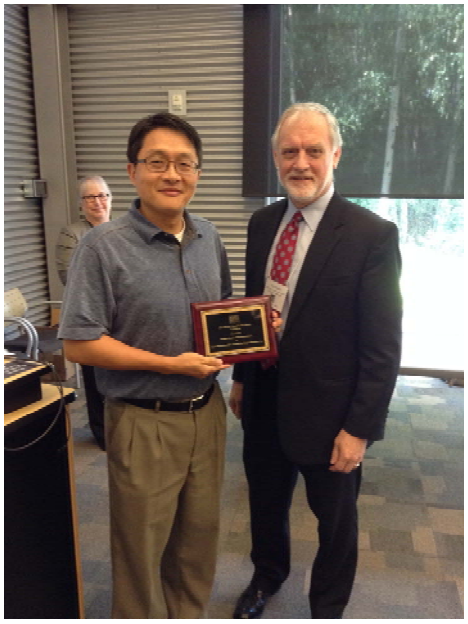
Joined Forces: *www.getpreparedcalifornia.org*
CRMP: *www.californiaresidentialmitigationprogram.com*
EBB: *www.earthquakebracebolt.com*

Award in Excellence for Legislation

Administering Agency:	Oregon House of Representatives
Program/Project Name:	*House Resolution 0003 – Creating the Oregon Resilience Plan*
Contact:	Representative Deborah Boone – District 32
Address:	900 Court St. NE, H-375, Salem, OR 97301
Email:	*Rep.DeborahBoone@state.or.us*

Program Summary

Following an editorial calling for resilience planning for a Cascadia earthquake and tsunami and then witnessing the devastation from the very similar Tohoku, Japan 3/11/11 event , Representative Deborah Boone sponsored House Resolution 0003 to mandate the development of a state-wide resilience plan for Oregon's inevitable M9 event. It passed unanimously in the House of Representatives with major sponsorship from the Oregon Senate. The Resolution directed the Oregon Seismic Safety Policy Advisory Commission (OSSPAC) to lead and coordinate the preparation of an Oregon Resilience Plan (ORP). The Resolution called on OSSPAC to include the Governor's Public Safety Advisor, State agencies, Commissions, and other advisory bodies as needed. Its goal was to get an integrated view of state capabilities and gaps in resilience planning.



This was the first time that a State Legislature requested a state-wide resilience plan directed to a specific seismic event that put the entire state at risk. It also was unusual in the breadth of its scope, and addressed the need to establish Critical Transportation Infrastructure to provide reliable lifelines for emergency response and economic recovery following a Cascadia Earthquake and Tsunami, called for the seismic upgrades of public buildings, made special note of continuing to seismically upgrade schools, and invest in additional tsunami evacuation options for the Oregon coastal communities.

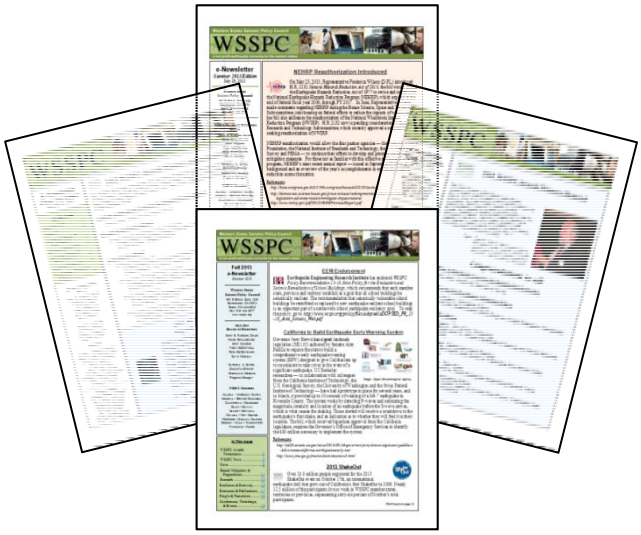
The approved Resolution – which passed the Legislature in 2011 – indicated that the ORP should be presented to the Legislative Assembly no later than February 28, 2013, a date OSSPAC met. They completed the plan with the help of 169 contributors, including members of 8 work task committees and an independent advisory committee. After its delivery, the ORP was reviewed at five joint Senate-House legislative committee hearings in the 2013 Legislative session, resulting in the passage of Senate Bill 33, which created an Implementation Task Force (ITF) made up of members of the Governor's Office, the Legislature, State Agencies, scientific community, OSSPAC, the private sector, non-profit sector, special districts, League of Oregon Cities, and the Association of Oregon Counties to make recommendations of how to implement the Oregon Resilience Plan. ITF recommendations and priorities are to be delivered to the 2015 legislature.

More information can be found at:
http://www.oregon.gov/omd/oem/pages/osspac/osspac.aspx#Oregon_Resilience_Plan

OUTREACH

e-Newsletter

Western States Seismic Policy Council has published a quarterly newsletter highlighting WSSPC member news since 1995; in 2008, the newsletter became an electronic "e-Newsletter" to provide easier access. Sections include summaries of WSSPC member news; hazard mitigation and preparedness activities; research findings; updates on the recovery and resiliency of previous earthquake and tsunami-impacted areas; earthquake and tsunami publications and resources; and updates on WSSPC members.



The e-Newsletter is distributed to hundreds of WSSPC members and affiliates, other earthquake consortia members, earthquake organizations, Federal Emergency Management Agency (FEMA) representatives, and United States Geological Survey (USGS) contacts. Current and previous e-Newsletters are available for download from the WSSPC website at *http://wsspc.org/news/newsletters.shtml*

WSSPC encourages member agencies – as well as other earthquake and tsunami organizations – to forward their information and news items for inclusion in upcoming editions. Over 325 people are receiving the e-Newsletter. To subscribe to the WSSPC e-Newsletter, send an email to *mbates@wsspc.org*.

Monthly Bulletin

Western States Seismic Policy Council began publishing a monthly bulletin in December of 2014. The online publication is distributed every month a quarterly newsletter is not. Monthly bulletins include upcoming events and time sensitive news concerning WSSPC members.

The monthly bulletin is distributed to hundreds of WSSPC members and affiliates, other earthquake consortia members, earthquake organizations, Federal Emergency Management Agency (FEMA) representatives, and United States Geological Survey (USGS) contacts. Current and previous monthly bulletins are available for download from the WSSPC website at *http://www.wsspc.org/wsspc-monthly-bulletins/*

WSSPC encourages member agencies – as well as other earthquake and tsunami organizations – to forward their information and news items for inclusion in upcoming editions. Over 325 people are receiving the monthly bulletin. To subscribe to the WSSPC monthly bulletin, send an email to *mbates@wsspc.org*.

WSSPC.org

The WSSPC website – *www.wsspc.org* – showcases our official documents and publications, and provides links to WSSPC members' agencies, WSSPC technical committee activities, annual *Awards in Excellence* profiles, and earthquake and tsunami resources. To gauge the website's effectiveness, WSSPC has been using Google Analytics to monitor visitor statistics to the website. This web-based tool provides us with a comprehensive overview of website visits; visitors' geographical locations; pages viewed; keywords and third-party links used to find our site; and how quickly visitors leave the site.

2014 Summary

In March of 2014, WSSPC launched our redesigned website and switched our website platform from Dream Weaver to WordPress. With this change, our analytics also switched from Webstat to Google Analytics. We have added a lot of content to our website and there are over 500 attached files. Some of our webpages include state reports, policy recommendations, and mitigation.

When we release our quarterly e-newsletter and our monthly bulletin, we note an increase in visitors to the website, and a corresponding decrease in our bounce rate, which monitors how quickly a visitor leaves the website after accessing it.

Total Visits *December 2013 – November 2014*	
Quarter 1	1,734
Quarter 2	1,646
Quarter 3	1,184
Quarter 4	1,592
Total Visits	**6,156**

Total Pages Viewed from Visitors *December 2013 – November 2014*	
Quarter 1	3,556
Quarter 2	7,192
Quarter 3	2,323
Quarter 4	4,337
Total Pages Viewed	**17,408**

Lower bounce rate percentages indicate more visitors are continuing to one or more additional pages after initially entering our site. Bounce rates vary significantly during the course of a year, but we are noticing that visitors are staying longer, implying we are garnering greater interest in the content displayed on WSSPC pages.

The *Total Visits* (left) lists the number of visitors to the site. The Total *Pages Viewed by Visitors* (left) lists the number of pages viewed on the *www.wsspc.org* site. The 2013-2014 fiscal year yielded over 17,000 page views. The higher page views in the second quarter are due to the newly launched website, and new documents posted for the National Earthquake Program Managers Meeting and the WSSPC Annual Meeting.

A number of third party websites refer visitors to our pages through links posted on their websites, as shown in the table on page C-14. With the exception of FEMA and USGS, most of the top referrers are from the western states, reflecting the continued visibility of the WSSPC website link on our members' and partners' websites.

This year, Google searches led visitors to our pages from 64 countries around the world; the top five include the United States, Russia, Canada, Germany, and Australia.

Third Party Links to WSSPC

The following WSSPC members and partner organizations have added a *www.wsspc.org* hyperlink to their agency's website to facilitate easy visitor access.

Organization	Link Location
Alaska Division Homeland Security and Emergency Management	http://ready.alaska.gov/links.htm
Alaska Division of Geological and Geophysical Surveys	http://www.dggs.dnr.state.ak.us/links/geology-links.php
Emergency Management British Columbia	http://www.embc.gov.bc.ca/em/em_links/em_links.html
California Geological Survey	http://www.conservation.ca.gov/cgs/shzp/Pages/SHMPmorelinks.aspx
California Seismic Safety Commission	http://www.seismic.ca.gov/links.html
Cascadia Region Earthquake Workgroup	http://www.crew.org/news-events/blog/wsspc-releases-tsunami-report
Central U.S. Earthquake Consortium	http://cusec.org/earthquake-information/resources-a-links.html
Colorado Division of Emergency Management	http://www.coemergency.com/search/label/earthquake
Federal Emergency Management Agency	http://www.fema.gov/earthquake-contacts/regional-earthquake-consortia
Idaho Bureau of Homeland Security	http://www.bhs.idaho.gov/Pages/Preparedness/Hazards/NaturalHazards/Earthquake.aspx
Montana Bureau of Mines and Geology	http://mbmgquake.mtech.edu/news.html
Nevada Division of Emergency Management	http://dem.nv.gov/links/
Nevada Bureau of Mines and Geology	http://www.nbmg.unr.edu/Links.html
Nevada Earthquake Safety Council	http://www.nbmg.unr.edu/nesc/
New Mexico Dept. of Homeland Security and Emergency Management	http://www.nmdhsem.org/Preparedness_Links.aspx
New Mexico Bureau of Geology and Mineral Resources	http://geoinfo.nmt.edu/links/home.html
Oregon Emergency Management	http://www.oregon.gov/OMD/OEM/plans_train/earthquake.shtml
Oregon Dept. of Geology and Mineral Industries	http://www.oregongeology.org/sub/links/EQlinks.HTM
Oregon Seismic Safety Policy Advisory Commision	http://www.oregon.gov/OMD/OEM/osspac/osspac.shtml
United States Geological Survey	http://earthquake.usgs.gov/other_eqsites.php
Utah Seismic Safety Commission	http://ussc.utah.gov/threat.html
Utah Division of Emergency Management	http://publicsafety.utah.gov/emergencymanagement/mainlinks.html
Washington Emergency Management Division	http://www.emd.wa.gov/hazards/haz_earthquakes.shtml#Prep
Washington DNR, Earth Sciences Division	http://www.dnr.wa.gov/ResearchScience/Topics/GeologicHazardsMapping/Pages/eqlinks.aspx
Wyoming State Geological Survey	http://www.wsgs.wyo.gov/Research/hazards/Earthquakes.aspx
Yukon Emergency Measures Organization	http://www.community.gov.yk.ca/emo/links.html

Social Media

Western States Seismic Policy Council has integrated social media into the website and has made a concerted effort to utilize it in 2014. Social media is used to distribute information and connect with a larger audience. WSSPC has a Twitter and Facebook account that is updated regularly. Every time we distribute an e-newsletter or monthly bulletin, we also put them on both platforms. Through the use of hashtags, we have seen our following grow. At the end of November 2014, WSSPC has 50 followers on Twitter and 61 "Likes" on Facebook.

The links to WSSPC's social media are located below.

Twitter: *https://twitter.com/wsspc*

Facebook: *https://www.facebook.com/WSSPC*

COLLABORATION

National Earthquake Program Managers Meeting

The National Earthquake Hazards Reduction Program (NEHRP) – implemented through the joint efforts of the Federal Emergency Management Agency (FEMA), the National Institute of Standards and Technology, the National Science Foundation, and the U.S. Geological Survey – was established by Congress in 1977 to lead the federal government's efforts to reduce the fatalities, injuries, and property losses caused by earthquakes.

As a component of NEHRP, many U.S. state and territorial governments have designated an earthquake program manager or coordinator to work on statewide earthquake risk reduction activities in order to reduce earthquake-related losses; the position is typically housed within the emergency management agency. Each year, a group of these representatives participate in the "National Earthquake Program Managers" (NEPM) meeting to develop programs and best practices, and foster relationships.

WSSPC helped plan and coordinate the 2014 meeting, which was held at the FEMA Region VIII in Lakewood, Colorado, May 21-22 with an optional field trip to the National Earthquake Information Center (NEIC). Per NEPM's website, the goal of the meeting was to The goal of the meeting was to continue dialogue and relationship building between State Earthquake Program Managers and key stakeholders since the 2013 NEPM Meeting in Seattle, Washington. A central component of the meeting included a strategic planning session on how States and FEMA NEHRP, and the FEMA NEHRP Partners can continue building successful programs.

Above: NEPM Field Trip to the USGS National Earthquake Information Center in Golden, Colorado. Image: Courtesy of Brian Blake, CUSEC

This year's meeting included a variety of sessions for earthquake program managers and partners, including:

- State Earthquake Program Updates
- FEMA NEHRP Updates
- NEHRP Partners Updates
- State Earthquake Program Strategic Planning
- FEMA NEHRP Partners Strategic Planning
- Earthquake Early Warning Training provided by WSSPC

More information on the 2014 NEPM meeting can be found at: *http://eqprogram.net*. The Earthquake Early Warning presentations are posted on the WSSPC website at *http://www.wsspc.org/resources-reports/eq-early-warning/2014-eew-workshop/*.

SECTION D

Policy

Subsection D-1

WSSPC Policy Committees

WSSPC POLICY COMMITTEES

WSSPC uses policy committees – consisting of members, members' agency representatives, and affiliate members – to develop and provide initial review of WSSPC's earthquake and tsunami policy recommendations. There are three standing policy committees: Basin and Range Province Committee, Engineering, Construction, and Building Codes Committee, and Tsunami Hazard Mitigation Committee.

Basin and Range Province Committee

The Basin and Range Province Committee (BRPC) seeks to promote the understanding and study of seismic hazards in the Basin and Range Province (BRP) of the western U.S., and to provide advice and recommendations to policy-making bodies regarding seismic hazards and risk in that region.

Basin and Range Province
Image: USGS

The BRPC consists of geoscientists and emergency managers from Basin-and-Range Province states (Arizona, Idaho, Nevada, New Mexico, and Utah). The BRPC states share common concerns regarding earthquake hazards and risk in the Basin and Range Province (BRP). Among those concerns are the large number of poorly studied or unstudied potentially active normal-slip faults in the BRP; the close proximity of known active faults to BRP urban centers; long recurrence intervals between damaging BRP earthquakes, leading to complacency on the part of both citizens and policy makers; unknowns regarding BRP fault behavior (earthquake clustering and triggering, multi-segment rupture, stress drops, BRP-specific attenuation relations); and the difficulty of preparing for damaging earthquakes in rural areas lacking adequate resources for planning and emergency response.

Goals pursued by the BRPC include promoting scientific research and emergency management functions in the BRP, establishing post-earthquake technical information clearinghouses, establishing informal cooperative agreements between states for technical assistance in the event of a damaging earthquake anywhere within the BRP, and facilitating information dissemination regarding the latest technical research and emergency response issues in the BRP.

Members:

EM = Emergency management representative
GS = Geologic survey representative
SSC = State seismic commission representative

2014 Chair: Bill Phillips, Idaho Geological Survey

Rick Allis, Utah GS
Lee Allison, Arizona GS
Kent Atwood, Montana EM
Wendy Blackwell, New Mexico EM
Bob Carey, Utah EM
Michael Conway, Arizona GS
Anthony Cox, Arizona EM
Craig dePolo, Nevada GS
Jim Faulds, Nevada GS
Melinda Gibson, Wyoming GS
Rob Jackson, Colorado SSC
Dan Koning, New Mexico GS
Dave Love, New Mexico GS
Bill Lund, Utah GS (Past Chair)
Ian Madin, Oregon GS
John Metesh, Montana GS
Phil Pearthree, Arizona GS
L. Greer Price, Nevada GS
Mark Stephensen, Idaho EM
Mike Stickney, Montana GS
Seth Wittke, Wyoming GS
Jeri Young, Arizona GS

Engineering, Construction, and Building Codes Committee

The Engineering, Construction, and Building Codes Committee considers the need for and requirements of seismic building codes and incentives for building owners to retrofit older buildings.

Members:

2014 Chair: Ron Lynn, Nevada SSC

Rob Jackson, CO SSC
Mike Mahoney, Federal Emergency Management Agency
Pete McDonough, Utah SSC
Patrick Otellini, City and County of San Francisco
Woody Savage, U.S. Geological Survey, Emeritus
Mark Stephensen, Idaho EM
Yumei Wang, Oregon SSC
Barry Welliver, Utah SSC

Tsunami Hazard Mitigation Committee

The Tsunami Hazard Mitigation Committee coordinates and implements tsunami hazards mitigation plans and focuses on developing policies based on the current technology and science.

Members:

2014 Chair: Vicki McConnell, Oregon GS

Jacinta Brown, American Samoa EM
Pilar Carbullido, Guam EM
Kathryn Forge, British Columbia EM
Ann Gravier, Alaska EM
Rich Koehler, Alaska GS
Paul Okubo, Hawaii SSC
John Madden, Alaska EM
Richard McCarthy, California SSC
Kevin Miller, California EM
Teron Moore, British Columbia EM
Dave Norman, Washington GS
Erv Petty, Alaska EM
George Priest, Oregon GS
Kevin Richards, Hawaii EM
Althea Rizzo, Oregon EM
John Schelling, Washington EM
Tim Walsh, Washington GS
Rick Wilson, California GS
Kent Yu, Oregon SSC

Subsection D-2

Policy Recommendations Adopted in 2014

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 14-1

Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources

Policy Recommendation 14-1

WSSPC recommends expanding the efforts by NOAA, the USGS, FEMA, and WSSPC members to enhance public education programs about the potential for impacts from local tsunamis and the need to evacuate threatened areas immediately after strong or sustained ground shaking; giving prioritization to these efforts, which have an immediate and direct impact on life-safety for local tsunamis, over deep-sea tsunami detection systems that have no benefit for local warnings. WSSPC also recommends robust, effective, and fully maintained implementation of the tsunami detection system by NOAA, as long as it is not at the expense of community-level tsunami preparedness, mitigation, and recovery planning.

Executive Summary

The efforts of the U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) to maintain the current array of the nation's seismic monitoring system, coastal tide gauges, and the deep-ocean tsunami detection system (DART) are vital to reduce loss of life from distant tsunami. However, in the case of many locally sourced tsunamis, the time before impact is so brief that the most effective means for protecting the public is not through warning systems, but through sustained community outreach and education. Buoys, sirens, and loudspeakers, etc., are meaningless if the general public does not know what to do in the critical few minutes following an earthquake that generates a deadly and damaging tsunami.

To be most effective, community outreach and education requires an ongoing commitment by state and local governments partnering with the federal government through the National Tsunami Hazard Mitigation Program (NTHMP) to implement robust, long-term education programs reinforced by exercises and training, and subsequently measured and evaluated using social science surveys. The Tsunami Warning and Education Act provides the framework for the NTHMP collaboration and supports the full national effort to reduce loss of life from tsunamis. The Tsunami Warning and Education and Reauthorization Act (TWERA) is currently being considered by Congress.

Background

Tsunamis can be the most destructive and deadly hazard associated with an earthquake, not only to nearby coastal areas, but occasionally to regions thousands of miles from the source. According to the 2011 WSSPC paper titled: ***Tsunami Hazard Mitigation and Preparedness: A Perspective from State and Territory Tsunami Programs in the High Tsunami Risk Pacific Region***, eight significant tsunamis since 1946 have killed 392 people and caused over $1,600,000,000 in damages to WSSPC member states and territories. The 1946 and 1964 Alaskan earthquakes produced tsunamis that caused damage and/or loss of life in Hawaii, American Samoa and along the coasts of British Columbia, Washington, Oregon and California. The Pacific Tsunami Warning Center at Ewa Beach, Hawaii, and the National Tsunami Warning Center at Palmer, Alaska, were established as a result of these destructive tsunamis and because of the need to warn coastal populations of tsunamis from distant sources.

Pacific States, Provinces and Territories must also plan for locally generated coastal earthquakes that provide little or no time to issue a general public warning of a destructive tsunami. Recent events in Japan (2011), Chile (2010), and American Samoa (2009), and Sumatra (2004) validate findings that a well educated and trained public is the most effective way to avoid catastrophic loss of life from a local tsunami. The 2013 Uniform California Earthquake Rupture Forecast (UCERF3) estimates a ten percent probability of a M 8.0 or greater earthquake somewhere along the Cascadia Subduction Zone (Cascadia Megathrust) in the next 30 years (Frankel and Peterson, 2013). During the past century, the Alaska-Aleutian Subduction Zone had a M 8.0 or greater earthquake on the average of every 16 years, four of which produced destructive tsunamis.

Therefore, it is vitally important to continually educate coastal residents, businesses, and visitors about the importance of immediate evacuation to high ground upon cessation of strong or sustained ground shaking. In areas where no high ground is nearby, vertical evacuation in approved engineered structures may be the only option to survive a tsunami impact. Members of coastal maritime communities exposed to tsunami hazards must also understand how to best protect life and property. Through the use of scientifically researched and developed tsunami inundation models, maps, and other products, community evacuation plans and guidance must be developed showing evacuation routing and safe zones both on land and at sea.

References

Frankel, Arthur D., and Petersen, Mark D., 2013, Appendix P – Models of Earthquake Recurrence and Down-Dip Edge of Rupture for the Cascadia Subduction Zone in: The Uniform California Earthquake Rupture Forecast, Version 3 (UCERF3) – The Time-Independent Model: USGS Open-File Report 2013-1165, CGS Special Report 228, and Southern California Earthquake Center Publication 1792, 13 p.

Western States Seismic Policy Council, 2011, Tsunami Hazard Mitigation and Preparedness: A Perspective from State and Territory Tsunami Programs in the High Tsunami Risk Pacific Region: WSSPC Report 2011-01, 30 p.
http://www.wsspc.org/wp-content/uploads/2013/10/WSSPC_Tsunami_Report_2011-01.pdf

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 14-3

Earthquake Monitoring Networks

Policy Recommendation 14-3

WSSPC advocates the continuation and expansion of earthquake monitoring networks as envisioned and supported by the Advanced National Seismic System (ANSS). ANSS emphasizes expanded strong-motion instrumentation in urban areas, including selected engineered structures, as well as increased regional broadband seismograph instrumentation. The resulting data will provide better understanding of future ground shaking potential, more rapid information for emergency response, and insights for the improved design of more earthquake-resistant new and retrofitted construction.

WSSPC calls upon all parties committed to earthquake loss reduction to advocate greater support of the U.S. Geological Survey's efforts to expand ANSS monitoring and to standardize data collection, processing, and storage. In addition, WSSPC calls upon USGS to prioritize operation and maintenance of the ANSS networks to comply with the USGS performance metrics. To further these efforts, WSSPC encourages strengthening partnerships among the USGS, State, and local public and private entities, as well as with emergency managers, engineers, and corporate response and business interruption planners.

Executive Summary

Earthquake monitoring is essential to provide accurate and timely data and information on earthquakes that can damage some buildings and other structures. Reliable and optimally useful monitoring can only be accomplished by employing modern methods and technologies in conjunction with comprehensive regional coverage. Current challenges include obtaining funding to replace outdated, inadequate, analog weak-motion instrumentation with digital systems that include broadband and strong-motion sensors, and improving the operational efficiency and reliability of seismic networks. Perhaps what is most critical is the lack of sufficient and uniform geographic coverage in areas of relatively high earthquake risk. Large and damaging earthquakes are not limited to California. During the past six decades, of the eleven M>7 earthquakes that occurred in the lower 48 states during the past six decades, three occurred in the Rocky Mountain region (the rest occurred in California). Yet the northern Rocky Mountain region remains without sufficient modern instrumentation, as does much of the Basin and Range province. Support for the continuing expansion of the nation's monitoring networks will be crucial in the coming decades for refinement of seismic hazard maps and emergency planning, for acquisition of data for earthquake engineering research, and to make it possible to provide earthquake early warning.

Background

Earthquake monitoring networks are essential both to respond effectively to earthquakes where and when they occur and to characterize future earthquake hazards. The earthquake parameters produced by modern seismic networks, when combined with historic earthquake catalogs and the paleoseismic record, are essential input for developing the Nation's probabilistic seismic hazard maps and analyses. Automated processing of earthquake information by seismic networks in the United States provides near-real-time information on earthquake locations, magnitudes, and patterns of moderate and damaging ground shaking. In the last decade, seismologists have expanded the capabilities of the seismic monitoring systems throughout the nation to routinely produce ShakeMaps for quakes with M>3.5, fault rupture orientations, and slip distributions and aftershock probabilities for quakes with M>6. ShakeMap has become a valuable tool to assist emergency responders in identifying the likely extent of earthquake damage. Strong-motion data (now increasingly available in real-time) can be correlated with documentation and evaluation of the performance of the built environment, leading to understanding the causes of earthquake damage and the occurrence of good structural and non-structural performance..

Since the 1960s, the U.S. Geological Survey (USGS) has operated, supported and coordinated local seismic networks to detect micro-earthquakes, including aftershocks of larger earthquakes. Data from these early seismograph networks have been used to delineate the spatial relationships between earthquake hypocenters and active faults. Modern earthquake monitoring networks provide fundamental earthquake data in the form of catalogs specifying hypocenter location, time of occurrence, and magnitude, along with compiled recordings of strong earthquake shaking in urban areas and in the vicinity of the fault ruptures causing earthquakes. These data find uses in diverse applications ranging from earthquake hazard analysis to disaster response. Seismic networks throughout the U.S. have provided fundamental data for the U.S. Geological Survey's National Seismic Hazard Mapping Project, which is generating ever-advancing state-of-the-art earthquake hazard maps for the U.S. The availability of earthquake monitoring network data has led to new and innovative research that has advanced the science of seismology through an improved understanding of the physics of earthquake occurrence.

For the western states, modern monitoring of regional earthquake activity is crucial. The largest proportion of the Nation's seismic hazard is in the western states, which are all exposed to large and damaging earthquakes. Two of the largest earthquakes in the lower 48 states during the past six decades have occurred in the Northern Rocky Mountain region (magnitude 7.3 1959 Hebgen Lake, Montana; and magnitude 7.0 1983 Borah Peak, Idaho). Yet the Northern Rocky Mountain region remains the largest seismically active region of the lower 48 states without sufficient modern instrumentation to fully locate and characterize earthquakes to meet ANSS standards. A similar deficiency exists in many active seismic regions of Alaska.

The advent of digital instrumentation since 1990 has revolutionized seismology. High-fidelity earthquake data transmitted in real-time via terrestrial and satellite communication links and are essential for all aspects of seismology. Digital dataloggers coupled with broadband and strong-motion sensors have the capability to record the full spectrum of earthquake-related ground motions—everything from the high frequencies of nearby earthquakes to the low-frequency, rolling motion of distant earthquakes. Most importantly, digital instruments have dynamic range sufficient to detect tiny earthquakes and yet able to remain on-scale for a major, nearby earthquake. Additionally, all three axes of ground motion (up-down, north-south, and east-west) are recorded (as opposed to only the vertical direction of ground motion recorded by older seismographs). High-quality recordings by even a few broadband seismographs from earthquakes with magnitudes as small as 3.5 allow computations that uniquely characterize the type of faulting, amount of energy released, and the stress field responsible for the quake. Likewise, high-quality strong-motion recordings in the urban environment are necessary to understand how seismic shaking can cause damage to buildings and other structures. This information is rapidly posted to the Internet, and data centers provide ready access to the information for rapid response and recovery as well as long-term research.

The vision of the next generation of national earthquake monitoring, the Advanced National Seismic System (ANSS), was issued in 1999 by the U.S. Geological Survey. Its design and partial implementation has been developed in consultation with earthquake specialists in academia and the States together with the engineering community. The mission of the Advanced National Seismic System (ANSS) is to provide accurate and timely data and information on earthquakes and their effects on buildings and structures, employing modern monitoring methods and technologies.

Since the ANSS was established by Congress in 2000, the USGS has fostered the organization of regional seismic networks developed through incorporation of local efforts into regional systems. ANSS regions are established for California, the Pacific Northwest, Alaska, Hawaii, the Intermountain region, the Central U.S. (including the Southeast), and the Northeast. The ANSS has deployed more than 2500 modern monitoring stations throughout the U.S. since its inception, with many installed in urban areas with the highest earthquake hazard.

Automated processing and distribution of earthquake information by regional seismic networks and the USGS National Earthquake Information Center provides near-real-time information to the public about earthquake location, magnitude, fault orientation, slip distribution, and aftershock probabilities. Together with other parties, the USGS has developed ShakeMap, an analytical methodology that creates maps of the predicted severity of ground shaking computed from observed peak ground motions recorded by modern

instrumentation and from the computed earthquake magnitude. ShakeMaps are posted to the Internet within minutes following earthquakes and also are distributed to emergency responders and other users through technologies like CISN Display and ShakeCast. The initial maps are automatically revised as new seismic data become available. In areas with a relatively dense distribution of strong-motion sensors, ShakeMap can help emergency managers immediately identify areas that have been exposed to strong shaking before damage reports are available. ShakeMap is being used in conjunction with earthquake loss modeling to make preliminary estimates of casualties and earthquake damage costs, such as through the USGS Prompt Assessment of Global Earthquakes for Response (PAGER) system.

ANSS instrumentation of engineered buildings and other structures to monitor their responses to earthquake ground motion remains less developed. Because of limited funding, a comparatively small number (~135) of structures have been instrumented so far. This type of monitoring is very important to the establishment of better building code requirements and design practices to achieve improved earthquake resistance in both new construction and retrofitted structures. Following damaging earthquakes, real-time monitoring of the response of lifelines and buildings is also valuable in emergency response.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 14-4

Identification and Mitigation of Unreinforced Masonry Structures

Policy Recommendation 14-4

Unreinforced masonry bearing-wall structures represent one of the greatest life-safety threats and economic burdens to the public during damaging earthquakes. WSSPC recommends that each state, province or territory adopt a program to identify the extent of risk that unreinforced masonry structures represent in their communities and develop recommendations that will effectively address the reduction of this risk.

Executive Summary

Unreinforced masonry is recognized by the Federal Emergency Management Agency as one of the structural building types most prone to failure during an earthquake. A review of the U.S. Geological Survey Hazards Program website listing earthquakes that generated 1,000 or more deaths since 1900 shows that unreinforced walls are a significant contributing factor in losses in both the financial sector and human lives.

WSSPC strongly believes that jurisdictions must be proactive to address this threat to their citizens. Legislatively mandated programs and/or local municipally adopted ordinances have proved effective at addressing this risk.

Background

During earthquakes, unreinforced masonry (URM) structures are vulnerable to catastrophic collapse and represent a significant life safety threat, as occurred in the 2008 Wells, Nevada earthquake. Unreinforced masonry structures are made from brick, hollow clay tile, stone, concrete block, or adobe materials that are not strengthened by the addition of steel or other reinforcement. Common building examples include older industrial complexes, schools, mercantile establishments, and private residences.

Also of concern are components of these structures such as walls, unsupported parapets, and fireplace chimneys, which can fall on sidewalk pedestrians or people trying to exit a building. The masonry usually is held together with weak mortar and is unable to resist lateral forces. Wall and roof anchorage tends to be inadequate, allowing floors and roofs to separate from the walls and collapse. Historically, this type of building damage has been a major contributing factor to loss of life in earthquakes throughout the world.

WSSPC recognizes that there is a societal cost to the inventory and retrofit or replacement of unreinforced masonry buildings, but in areas of high seismicity, failure to address this issue will have expensive and lethal consequences. In order to minimize the cost and make programs more politically acceptable, the three-stage approach of identifying the population of hazardous buildings, analyzing the risk presented by these buildings, and prioritizing the retrofitting of those buildings deemed to be a hazard is recommended.

It is realized that resistance is to be expected when dealing with retroactive building ordinances. However, as can be seen by those areas that have adopted fire sprinklers retroactively, versus those that have not, even minimal remediation can yield discernible life-saving results. The International Existing Building Code Appendix Chapter 1, the American Society of Civil Engineers National Standard ASCE 41-13 “Seismic Evaluation and Retrofit of Existing Buildings” and retrofit concepts described in FEMA publications for unreinforced masonry structures are available; however, this in no way negates the need for local engineering analysis and design.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 14-5

Earthquake Emergency Handbook for First Responders and Incident Commanders

Policy Recommendation 14-5

The Western States Seismic Policy Council (WSSPC) recommends that an Earthquake Emergency Handbook for first responders and incident commanders be developed, preferably by an interagency task force.

Executive Summary

Most emergency first responders and incident commanders have not experienced a damaging earthquake, and therefore are unfamiliar with the nature of earthquake hazards and how to properly respond to an earthquake emergency and its aftermath. An earthquake emergency guide, similar to the Fireline Handbook for wildfires, is needed to address response issues specific to earthquakes.

Background

The Fireline Handbook is a valuable tool for first responders and incident commanders dealing with wildfires. The Fireline Handbook was developed by the Incident Operations Standards Working Team, which was sponsored by the United States Department of Agriculture, the United States Department of Interior, the National Association of State Foresters, the United States Fire Administration, and the Intertribal Timber Council. This handy document is used at essentially all major wildfires, and the importance and utility of the handbook is underscored by the variety of organizations that joined together to produce and subsequently adopt it. Among other things, following the handbook can avoid putting fire responders at undo risk and avoid potential injuries because the handbook incorporates the hard won lessons learned and accumulated wisdom from fighting many fires, and compiles that information into an easy and quick to use format.

Most emergency first responders and incident commanders have not experienced an earthquake, and therefore are unfamiliar with the nature of earthquake hazards and how to properly respond to an earthquake emergency and its aftermath. This is because the repeat time between large, damaging earthquakes is relatively long compared to many other natural hazards such as wildfires. Unfortunately, the consequences of an earthquake and related hazards in its aftermath can be catastrophic. The incident commander for the 2008 Wells, Nevada earthquake was unfamiliar with earthquake hazards and had to learn the basics of earthquake emergency response while responding to the event. He expressed the need for an earthquake emergency guide similar to the Fireline Handbook. Developing an Earthquake Emergency Handbook was also the number one "lesson learned' in the emergency response section of the Wells earthquake disaster review (dePolo and LaPointe, 2011).

References

dePolo, C.M. and LaPointe, D.D., editors, 2011, *The 21 February 2008 Mw 6.0 Wells, Nevada earthquake - A compendium of earthquake-related investigations prepared by the University of Nevada, Reno*: Nevada Bureau of Mines and Geology Special Publication 36, variously paginated. (*http://www.nbmg.unr.edu/Pubs/sp/sp36*)

Incident Operations Standards Working Team, 2004, *NWCG Fireline Handbook:* National Wildfire Coordinating Group Handbook 3, variously paginated.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 14-7

Earthquake Early Warning Systems

Policy Recommendation 14-7

WSSPC supports the research, development, and implementation of earthquake early warning systems in those states or regions with high seismic risk and a seismic network that can, or can be enhanced to, support an early warning capability.

Executive Summary

An earthquake early warning is issued very rapidly following the initiation of an earthquake and provides alerts to people and communities that have not yet experienced ground shaking from the earthquake. Earthquake early warnings are possible because earthquakes produce differing types of waves that travel at different speeds. The faster P waves travel at about 6.5 kilometers per second and are first to arrive at seismic monitoring stations. These P waves contain important information about the size and location of the earthquake. Slower moving S waves (3.5 km per second) arrive after the P waves and cause more intense shaking capable of damage to buildings and infrastructure.

Based on information from the earlier arriving P waves, the expected shaking intensity can be estimated through rapid analysis and alerts can be issued to communities likely to be impacted by the earthquake. These alerts can be transmitted through high speed telecommunications systems so communities that are distant from the earthquake epicenter but vulnerable to strong motion may receive warning a few seconds to a few tens of seconds warning prior to the arrival of damaging S waves. Alert times vary from almost no warning in the area nearest the epicenter to 60-80 seconds in areas at some distance from the epicenter. As implied in this description, earthquake early warnings are of greatest benefit when large, though rare, earthquakes can impact vulnerable regions that are relatively remote from the epicenter.

Background

A nationwide earthquake early warning system was implemented in Japan on October 1, 2007. The system is based on Japan's extensive and dense seismologic and strong-motion networks that were enhanced following the January 17, 1995 Hanshin-Awaji (Kobe) earthquake. In Japan's earthquake early warning system, warnings are received through computers, cell phones, the media and signaling devices installed in homes, critical facilities and businesses. Early warnings are used to slow or stop high speed trains (*Shinkansen*), alert drivers of motor vehicles, control elevators (to prevent people being trapped), regulate industrial processes and notify people at home or work that they should move away from hazards and protect themselves. Limited systems are in place in Mexico, Turkey, Italy, and Greece, and Taiwan plans to introduce a system like Japan's in the near future.

The United States has followed scientific and technological developments in other nations, and although it has not yet implemented a fully operational earthquake early warning (EEW) system, the United States Geological Survey (USGS) has supported the development and trial operation of EEW with university partners and the State of California since 2006. Those efforts have resulted in a demonstration system called ShakeAlert that began sending test notifications to selected users in January 2012. While that system has demonstrated the feasibility of earthquake early warning in California, the system is still being tested for reliability and robustness.

An EEW system for the West Coast is being developed within the current operations of the Advanced National Seismic System (ANSS) regional seismic networks: California Integrated Seismic Network (CISN), and the Pacific Northwest Seismic Network (PNSN). This enables USGS/ANSS and its network partners to leverage its substantial investment in sensor networks, data processing centers, and software for earthquake monitoring, and takes advantage of the considerable expertise and experience of current personnel, reducing the cost of implementing EEW by using existing capabilities and facilities.

In September 2013 the California Legislature authorized (Section 8587.8 of the California Government Code) the California Governor's Office of Emergency Services, in collaboration with the California Institute of Technology, the California Geological Survey, the University of California, the United States Geological Survey, the Alfred E. Alquist Seismic Safety Commission

and other stakeholders, to develop a comprehensive statewide earthquake early warning system through a public-private partnership. In addition, the Office of Emergency Services will identify funding sources for the earthquake early warning system that do not specify the State's General Fund as a source. It is intended that the California Earthquake Early Warning System (CEEWS) commence full deployment in 2016.

Within California, development of CEEWS has begun by the core members of the California Integrated Seismic Network (USGS, Caltech, UC Berkeley, California Geological Survey, and California Office of Emergency Services). A primary constraint on the timeline for implementation of CEEWS in the highest risk area of the country is funding. In addition, policy, management structure, user applications, and public education and training will impact the implementation of earthquake early warning.

The California Office of Emergency Services plans to carry out the provisions of the legislation by convening five committees that include those institutions identified in the Government Code and other stakeholders and subject matter experts as deemed appropriate by the Project Managers. The product of these committees will be a well-articulated and comprehensive plan that describes an operational earthquake early warning system for California that is based upon a public-private partnership with clearly delineated organizational responsibilities and management structure, conforming to the highest scientific and technical standards of performance, and supported by a rational and feasible funding strategy independent of the California state General Fund.

Although earthquake early warning systems should not be imposed at the expense of hazard education and preparedness activities, and other mitigation programs, earthquake early warning systems have the potential to save lives and reduce financial losses. Those states that have urban populations and infrastructure vulnerable to major earthquakes as well as modern digital seismic networks may consider earthquake early warning as another useful tool for addressing the earthquake hazard. Earthquakes are often described as hazards without warnings, but seismic-network-based early warning systems could provide an alert with sufficient time to implement life safety actions and rapid mitigation.

Subsection D-3

Policy Recommendations Adopted in 2013

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-1

Rapid Tsunami Identification and Evacuation Notification

Policy Recommendation 13-1

WSSPC recommends that each coastal state, province, and territory emergency management agency work with coastal jurisdictions to develop evacuation plans for both local- and distant-source tsunamis, which have in place evacuation and re-entry notification systems, and supplement these emergency plans with a preparedness education campaign focusing on instructions to evacuate based on ground shaking, that ensures all populated coastal areas in the WSSPC coastal states, territories and provinces are guided by at least one type of system, appropriate to local conditions.

Executive Summary

Coastal jurisdictions should develop emergency response plans which incorporate both local-source tsunamis, where there may be only minutes to evacuate, and distant-source tsunamis, where there may be hours to evacuate. For local-source tsunamis, a robust education and preparedness campaign should focus on the importance of "natural" warnings, such as earthquake ground shaking felt at the coast as precursor to an incoming tsunami. For distant source tsunamis, emergency response plans should utilize redundant warning and communication systems and use nationally standardized systems which, in addition to standard evacuation and re-entry protocols, could include evacuation instructions via EAS to television and radio broadcast participants, automated telephone notification systems (e.g. reverse-911) and implementation of cell phone notification capabilities. The use of social media, phone trees, NOAA weather radios, satellite and cable television, and possibly beach-front sirens, if sirens are deemed effective and within a community's budget could further augment rapid dissemination of time sensitive tsunami alerts. Portions of this could be accomplished through adherence to planned implementation of the Integrated Public Alert and Warning System (IPAWS). These warning and notification systems should be tested on a consistent basis for confirmation of performance and improved efficiency during an event. WSSPC will work with its federal partners and the National Tsunami Hazard Mitigation Program to help maintain a consistent and effective, top-to-bottom warning system and public preparedness strategy.

Background

Tsunamis have caused considerable damage and casualties to populated areas in the Pacific region over the last 100 years. Tsunamis most often are created by the rapid uplift of the sea floor during subduction zone earthquakes and by landslides triggered by the shaking locally. Tsunamis not only affect nearby coastlines within a few minutes following an earthquake, but can travel long distances and impact distant shorelines within several hours.

For distant source events, tsunami preparedness and response plans should include response to tsunamis, whether in "Warning" or "Advisory," in order to help reduce over or under evacuation of coastal areas.

Where nearby coastlines are affected, the public is instructed to move away from the shoreline and to high ground whenever strong or long ground shaking is felt, or in some cases, when any ground shaking is felt. People would only return to low lying coastal areas following receipt of an official all clear message. Whether the tsunami is generated from a distant source or from a local source, effective notification of the public is paramount.

Permanent residents and visitors occupy a variety of geographical locations and structures along the shoreline. Therefore, the use of redundant warning systems would increase the immediacy and the coverage of the evacuation notification. These warning systems could include evacuation alerts and instructions through radio broadcasts, NOAA weather radios, focused reverse-911 cell phone calls, social media, or sirens focused on beach areas, if sirens are cost-effective and beneficial for a community. Portions of this could be accomplished through adherence to planned implementation of the Integrated Public Alert and Warning System (IPAWS). Only with multiple systems can the best and most immediate coverage be obtained, thereby potentially minimizing the number of injuries and loss of life from the tsunami.

Placement of tsunami warning signs is an important aspect of educating the public about how to reach safety upon receipt of a warning. Signs are a proven education tool in recent tsunamis and should be implemented as determined appropriate by local authorities, with possible assistance from NTHMP in order to maintain continuity between coastal jurisdictions and states. Coastal jurisdictions should be encouraged to adopt standardized tsunami signs.
(See Also: *http://www.dot.ca.gov/hq/traffops/signtech/signdel/tsunami.htm*)

Regular and frequent testing of warning systems is essential to identify mitigation strategies for a more resilient and effective system. It is important to know that the system will work as intended should public safety officials ever need to send an alert or warning to a large region of the United States. Only a complete, top-down test can provide an appropriate diagnosis of the system's performance.

In some instances, ground shaking may be a precursor, and an "early warning," to the occurrence of a tsunami. People in all coastal jurisdictions should be prepared to evacuate for higher ground when they feel strong or long duration ground shaking. Because many earthquakes do not cause tsunamis, a tsunami warning system should also be able to determine as quickly as possible if evacuation activities are necessary. Unnecessary evacuations are costly not only in terms of human risk and lost commerce, but in the public's negative reaction to the next earthquake experienced on the coast. The warning system should include: 1) earthquake and tsunami detection by a modern seismic network and Tsunami Warning Centers, respectively; 2) tsunami warning transmissions from the Tsunami Warning Centers to state and local emergency operations personnel; and, 3) direct notification to the coastal inhabitants, through the use of broadcast media, as well as other locally appropriate measures (such as social media, coastal sirens, reverse 911, phone tree, etc.) to initiate emergency response plans.

Continued education is crucial to inform coastal residents and visitors of procedures to evacuate coastal areas upon feeling strong or long ground shaking and not wait for official notices.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-3

Post-Earthquake Technical Clearinghouses

Policy Recommendation 13-3

WSSPC recommends that each member state, province, and territory establish a plan for a post-earthquake technical clearinghouse to be activated if possible within 24 hours after each major earthquake within its jurisdiction. WSSPC also recommends that multijurisdictional agreements between and among WSSPC members and Federal agencies be in place that would allow for the establishment of a single comprehensive technical clearinghouse in the event of a large earthquake.

Executive Summary

Post-earthquake technical clearinghouses have been an important component of emergency response, recovery, and mitigation following large earthquakes. A technical clearinghouse, either established in a physical location or web based (virtual), can serve to coordinate post-earthquake investigations to provide timely hazards observations for state and federal emergency managers, scientific communities, and the public. This information is then used to improve our assessments of earthquake hazards, earthquake engineering, mitigation strategies, economic losses, and emergency response to damaging earthquakes. The clearinghouse also serves to integrate, manage, disseminate and archive information so that it is available to decision makers.

Multijurisdictional cooperation is especially important in the event of a large earthquake that affects multiple states. Previously established Memoranda of Agreements (MOA) between and among WSSPC members and Federal agencies would allow for the establishment of a single comprehensive technical clearinghouse for such an event.

Background

Post-earthquake technical clearinghouses have been an important component of emergency response, recovery, and mitigation following large earthquakes. Seismologists deploy instruments that measure aftershocks and investigate the mechanics of earthquakes. Geologists and geotechnical engineers document ground failures, including fault displacements, fissures, landslides, rock falls, and liquefaction. Geodesists investigate ground deformation and related strain. Structural engineers evaluate the effects of the earthquake on various types of buildings, bridges, dams, utilities, and other structures. Social scientists study direct and indirect impacts to people and businesses. This information is then used to improve our assessments of earthquake hazards, earthquake engineering, mitigation strategies for nonstructural hazards, and emergency response to damaging earthquakes.

The data collected in the days immediately following a major earthquake can be critical during emergency response and recovery. Scientists and engineers can determine the likelihood that landslides will move (from rain or aftershocks), and can assess the susceptibility of structures to collapse. Some data are perishable and must be collected as soon as possible, before erosion or bulldozers eliminate the evidence or before aftershocks die out.

Data collected through clearinghouses help us to be better prepared for future large earthquakes. In addition, data on strong ground motion and damage to buildings helps to calibrate loss-estimation models. The Federal Emergency Management Agency's (FEMA) HAZUS, can be an important component of a Governor's or the President's disaster declaration as well as provide useful information for response, recovery and hazard mitigation.

A technical clearinghouse, either physical or web based (virtual), can serve to coordinate post-earthquake investigations and to share resources and information among investigators. The clearinghouse also serves to integrate and disseminate information so that it is available to decision makers and the media.

Post-earthquake technical clearinghouses were successfully implemented following the Landers, California (1992); Northridge, California (1994); Nisqually, Washington (2001); and Wells, Nevada (2008) earthquakes. A clearinghouse provides a place for scientists and engineers to report

on their findings each day. In some post-earthquake situations, a clearinghouse may serve as one of the chief mechanisms for relaying critical information from scientists and engineers investigating the earthquake to emergency managers.

Only California, Utah, and Nevada have developed plans for post-earthquake technical clearinghouses. Few WSSPC members have the resources to fully staff and operate a clearinghouse. Opportunities exist for members to collaborate with one another and to coordinate with the U. S. Geological Survey (USGS), FEMA, Earthquake Engineering Research Institute (EERI), university researchers, and other groups. The National Earthquake Hazards Reduction Program (NEHRP) agencies (USGS, FEMA, National Institute for Standards and Technology, and National Science Foundation) developed *The Plan to Coordinate Post-Earthquake Investigations* in 2003 (USGS Circular 1242) that includes provisions for cooperating with states to establish post-earthquake technical clearinghouses. Under this plan, the NEHRP agencies can step in and take the lead if WSSPC members are not prepared to establish a clearinghouse.

Multijurisdictional cooperation is especially important in the event of a large earthquake that affects multiple WSSPC members. Previously established Memoranda of Agreements (MOA) between and among WSSPC members and Federal agencies would allow for the establishment of a single comprehensive technical clearinghouse for such an event.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-4

Seismic Provisions in the 2012 International Building Codes

Policy Recommendation 13-4

WSSPC endorses the prompt adoption and enforcement of the seismic provisions of the 2012 *International Existing Building Code*, the 2012 *International Building Code*, and the 2012 *International Residential Code* as minimum standards by states, territories, provinces and/or local jurisdictions. Further, WSSPC discourages modifications or amendments that would weaken the Code or its required inspections. WSSPC also encourages Code organizations to continue the development and refinement of building codes and consensus standards to remain substantially equivalent to the National Earthquake Hazards Reduction Program (NEHRP) Recommended Seismic Provisions for New Buildings and Other Structures (FEMA 750) with a specific focus on purpose, education, incentives, lifelines and the business/industry and homeowner sectors.

Executive Summary

The *International Existing Building Code*, the *International Building Code* and the *International Residential Code* identify the minimum standards for the protection of life, limb and property. These consensus documents, which are supported by every major construction organization in the United States, provide the means for local jurisdictions, states and territories to protect their citizens, safeguard the economic vitality of their communities and provide for a sustainable environment. Amending seismic provisions out of the Code which are essential to the structural integrity of buildings compromises the effectiveness of the document and the safety of the community. Coinciding with Code adoptions is the need for appropriate training so the seismic resistant provisions may be consistently enforced and maintained. It is only through the unamended adoption of the seismic provisions of the International Code that a community has a legitimate expectation to be resilient in the event of disaster for its citizens, businesses and homes.

Background

Some states and many jurisdictions have not adopted the International Building Code, potentially leaving their citizens at continued risk. States should be encouraged to remove obstacles which hinder adoption, and to motivate local jurisdictions to diligently update existing codes. It is recognized that some jurisdictions which have adopted the International Codes have drastically modified or omitted the seismic provisions of the Codes. This action not only jeopardizes their structures by not providing for earthquake-resistant structures, but provides a false sense of security to their communities. Once adopted, the Codes must be uniformly and consistently enforced if they are to be effective. This will necessitate the training of building inspectors to some required standards for certification. Partnerships with the homeowners, residents, builders, insurers, owners, elected officials, scientific groups, and others with focused concerns on lifelines and public safety will be required to overcome the inertia of commitment to meet the desired outcomes.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-6

Post-Earthquake Information Management System

Policy Recommendation 13-6

WSSPC supports the development of a national Post-Earthquake Information Management System. The Management System would provide permanent archiving of essential data related to natural and socio-economic earthquake effects and the performance of the built environment from earthquakes within the United States, and could be combined with similar data systems that assemble and archive data from other natural hazards events, or geosciences data repositories that archive physical and electronic data

Executive Summary

Data collected after a major earthquake by both the public and private sectors is often lost because there is no systematic way to archive it, and thus the knowledge that could benefit society in the future is also lost. A national archive repository of post-earthquake information would allow practitioners to document, preserve, and access data on the natural, built and socioeconomic environments and to use this information to improve our understanding of earthquakes and reduce earthquake losses.

A national Post-earthquake Information Management System is supported by the Strategic Plan of the National Earthquake Hazards Reduction Program as a mechanism to achieve national risk reduction and mitigation goals. A scoping study for an information management system conducted by the American Lifelines Alliance (2008) states that "any national effort to reduce earthquake losses and social disruption resulting from severe natural hazard events requires a mechanism to capture and preserve engineering, scientific, and social performance data in a comprehensive and coherent system that will contribute to our learning from each disaster. Such a resource can play a vital role in efforts to enhance infrastructure and building design and to optimize mitigation, disaster planning, and response and recovery activities."

Background

Future improvements in the ability to engineer and construct buildings and other structures and infrastructure systems that can perform as needed in strong earthquakes depends on knowing about the performance resulting from current and past design and construction practices. No mechanisms are in place to systematically collect and archive these performance data for future use. Technical clearinghouses provide a means to assemble damage data reports that provide decision support for emergency management operations immediately following a significant event; however, much of that data is incompletely documented and becomes essentially lost soon thereafter. Data collected through post-earthquake technical clearinghouses (see WSSPC Policy Recommendation 13-3) and activities such as those sponsored by the Earthquake Engineering Research Institute (EERI) can help us to be better prepared for future earthquakes – if the data are adequately documented, securely archived, and identified in a manner to make them available for use decades into the future.

The Management System data archive would contain technical information collected by post-earthquake clearinghouses as well as other information related to the particular event. The Post-Earthquake Information Management System would be consistent with the recommendations in National Earthquake Hazards Reduction Program (NEHRP) Plan to Coordinate Post-Earthquake Investigations (USGS Circular 1242):

"It is critical to develop strategies for the formal and systematic archiving of data collected during post-earthquake investigations. These data, which focus on the natural, built, and socioeconomic environments, address a wide variety of phenomena. The data are voluminous and are acquired in many forms (for example, digital recordings, digital images, clipboard survey sheets, photographs, and narratives). If not organized and archived soon after an earthquake event, these data are often lost. No mechanism currently exists either to archive these data or to make them readily accessible to the research community. Because of this failure to adequately document, preserve, and access data, an enormous volume of highly relevant data has been effectively lost."

A similar national effort of scientific data preservation has been undertaken by the state geologic surveys and the USGS. The National Geological and Geophysical Data Preservation Act of 2005, Section 315 of the Federal Energy Act of 2005, authorized $30 million for each of 5 years to help develop databases and sample repositories across the nation. Where applicable, the Post-

Earthquake Information Management System could coordinate with this effort and provide a comprehensive data repository for all earth science and hazard information.

References

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http://www.nehrp.gov/pdf/alapimsreport.pdf

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http://www.nehrp.gov/pdf/strategic_plan_2008.pdf

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WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-7

Seismic Design of New Schools

Policy Recommendation 13-7

WSSPC recommends that each member state, province, and territory establish and fund an active program to improve the seismic safety of new schools and ensure that seismic building code provisions for new schools are followed. WSSPC also recommends that appropriate responsible local, state, and federal entities provide dedicated financial support for the establishment of a program that improves the seismic safety of new schools.

Executive Summary

School facilities, in addition to caring for our children, are often used as public assembly areas as well as areas of refuge or impromptu command centers during natural disasters and other emergencies. The use of schools in this fashion is commonplace throughout most of America, particularly so in rural areas. Current Building codes and design standards typically identify schools as an intermediate priority risk category. School facilities that are designed and built under this set of assumptions are constructed to ensure that the structure has earthquake survivability and is not specifically designed to remain functional (i.e. safe and habitable) after a design level seismic event. Additionally, in most instances there are no special seismic performance requirements for utilities such as water, electrical, sewer, and HVAC (Heating Ventilation and Air Conditioning). This presents an obvious problem where school facilities are used as emergency shelters or command centers. Increasing the school's design category to that of an essential facility would be more in conformance with its actual use, assure the safety of our children, and enhance the resiliency of the community.

Background

Currently schools are designed using the International Building Code Risk_Category III. Design standards and professional practices of care are consistent with the code's guidance. WSSPC encourages increasing the Risk Category to a Level IV, while employing a minimum of Seismic Design Category C for school facilities with an occupancy load of greater than 250 persons, to be more consistent with the construction of essential facilities.

Individual School Districts and private operators should also be made aware of FEMA 241 which addresses mitigating non-structural hazards from building contents, its use and occupancy. Post disaster assessments have identified that many common injuries and some types of damage can be prevented by properly mitigating non-structural hazards. There is also the additional benefit that school children would be better protected while attending classes.

Reference

FEMA 241, *Identification and Reduction of Nonstructural Earthquake Hazards in Schools*: Federal Emergency Management Agency, 18 p., July 1993.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-10

Joint Policy for the Evaluation and Seismic Remediation of School Buildings

Policy Recommendation 13-10

The Western States Seismic Policy Council, with the support of the Earthquake Engineering Research Institute, recommends that each member state, province and territory establish as a goal that all school buildings be seismically resilient. This recommendation that seismically vulnerable school buildings be retrofitted or replaced by new earthquake resilient school buildings is an important part of a nationwide school earthquake resiliency goal.

Executive Summary

Our elementary and secondary school buildings contain the future of our country. Parents send their children to school every day with the belief that their children will be safe. However, many of the schools located in WSSPC's states, provinces and territories are older structures vulnerable to severe damage and even collapse in future earthquakes.

This WSSPC Policy Recommendation is enacted in recognition that WSSPC member states and territories are attempting to undertake the process of increasing the seismic resilience of schools. The Policy Recommendation provides needed support for these efforts.

Background

The 1933 Long Beach, California M6.4 earthquake is best known for collapsing or severely damaging thousands of unreinforced masonry (URM) buildings, including over 230 school buildings. Fortunately, schools were not in session at the time of the earthquake. Had that been the case, thousands of children would have been injured or killed.

The outcry from this poor performance of school buildings directly led to the State of California passing the Field Act which mandated earthquake resistant construction requirements for future school buildings, and the Garrison Act which established the requirements for the seismic safety of existing school buildings.

Schools are increasingly used to shelter students in place during all hazards, including flood and hurricane as well as earthquakes. In addition, schools are often used as refuge zones for citizens within their communities. Thus school building resilience is a key to protecting the local population under diverse hazardous conditions.

There have been notable efforts by some WSSPC member states, including Idaho, Washington, Oregon and Utah, to identify at-risk school buildings and to begin the process of addressing the risk they present.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-11

Reliability of Lifeline Infrastructure

Policy Recommendation 13-11

WSSPC encourages improving the reliability and survivability of lifeline infrastructure and hereby supports the development of seismic design and performance guidelines for both new and existing infrastructure.

Executive Summary

Lifelines form a critical segment of the nation's infrastructure. Disruption can significantly affect the well-being of a community. Guidelines can serve as an effective method of identifying and reducing risk.

Background

Lifeline infrastructure including, but not limited to, electricity, gas, telecommunications, water, and waste water are critical to a community's wellbeing. Lifelines are being constructed without adequate seismic design and/or performance guidelines. Many existing lifelines have been constructed using old methods and technologies that are known to be inadequate by seismic experts.

Much of the nation's existing infrastructure has not been designed to tolerate extreme conditions exerted by major earthquakes, or earthquake-induced tsunamis, fault rupture, large landslides and liquefaction. Lifelines should have reliable performance to ensure that the region can withstand future earthquake damage without crippling consequences. Critical infrastructure requires vulnerability studies in order to understand potential damages and consequences. Mitigation of infrastructure with a high likelihood of failure with extreme consequences should be addressed. This policy recommendation is a reinvigorated effort to follow through on resolving infrastructure liabilities originally identified in FEMA 271 "Plan for Developing and Adopting Seismic Design Guidelines and Standards for Lifelines" (1995).

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 13-12

Earthquake Actuated Automatic Gas Shutoff Devices

Policy Recommendation 13-12

WSSPC recommends that each state, province or territory which is considering implementing requirements for installing automatic gas shutoff devices in industrial, commercial and/or residential applications assure that shutoff valves meet the provisions of the most currently available revision of ANSI/ASCE/SEI Standard 25 (Earthquake-Actuated Automatic Gas Shutoff Devices) and be installed in conformance with the manufacturer's installation instructions. The cost versus benefit of turning gas on after an event or the analysis of false activation is left to the jurisdiction. The policy only advocates that if a decision is made to proceed with earthquake actuated automatic gas shutoff devices that the current state-of-the-art provisions be utilized.

Executive Summary

Natural gas piping and appliances may be damaged during earthquakes, causing gas leaks. These leaks, if ignited, can result in fires and explosions which may jeopardize personal safety as well as resulting in significant damage to structures.

Fires and explosions may be more destructive to buildings than the earthquake itself. The ability to manually shut off a gas valve after an earthquake may be difficult or impossible due to debris or ground movement. Risk of gas related damage is further exacerbated if structures are unoccupied, thus placing the burden of shutting off gas service upon utilities or government agencies. The reliability of automatic gas shutoff valves has been greatly improved with the adoption of ANSI/ASCE/SEI Standard 25.

Background

A survey after the 1994 Northridge earthquake indicated automatic shutoff valves prevented "numerous gas related fires or explosions which reduced the need for water, firefighters and other emergency services" (Strand, 1998). Earthquake activated automatic gas shutoff devices are relatively inexpensive and a proven method to prevent the loss of gas, resultant fires and possible community conflagrations which might result from an errant spark.

While the installation of excess flow valves is currently mandated by Federal Code on new or replacement natural gas service lines serving single family residences, these valves may not detect leakage within structures caused by damaged or overturned appliances or equipment. The value of these may be enhanced by the addition of an automatic gas shutoff valve.

The suitability and conditions of the use of earthquake-actuated automatic gas shutoff devices should be reviewed and approved by the local jurisdiction having authority and such devices should comply with ANSI/ASCE/SEI Standard 25. Use of automatic gas shutoff valves can save lives and reduce the risk of property damage in areas of significant earthquake hazard.

Reference

Strand, Carl L., 1998, *Performance of Seismic Gas Shutoff Valves and the Occurrence of Gas-Related Fires and Gas Leaks During the 1994 Northridge Earthquake, with an Update on Legislation*, p. III-813, in: Proceedings of the NEHRP Conference and Workshop on Research on the Northridge, California Earthquake of January 17, 1994, Sponsored by the National Earthquake Hazards Reduction Program (NEHRP), Published by California Universities for Research in Earthquake Engineering, Richmond, California.

Subsection D-4

Policy Recommendations Adopted in 2012

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 12-1

Earthquake Planning Scenarios

Policy Recommendation 12-1

WSSPC recommends that each member state, province, and territory establish an active program to produce Earthquake Planning Scenarios for areas with high risk of earthquake losses. WSSPC also recommends that FEMA support the production of these Earthquake Planning Scenarios through its funding resources and in-kind services.

Executive Summary

Earthquake planning scenarios provide policy makers and emergency preparedness personnel with realistic assessments of the areas and types of structures and lifelines that are at most risk of damage, and estimated human casualties. Equally important, scenarios identify areas and infrastructure that are most likely to sustain little or no damage and remain functional following an earthquake, thereby minimizing the placement of valuable response assets in areas where they may not be needed.

The cost to prepare planning scenarios, and to update them regularly, is insignificant compared to the future savings from reduced losses to infrastructure, business economics, and human life when the information is used to develop effective seismic-safety policies. Minimizing future earthquake damage through prior planning, loss-reduction measures, and providing information to facilitate quick recovery is critical for maintaining earthquake-resilient communities.

Background

The U.S. Geological Survey indicates that losses to the U.S. built environment and to the U.S. economy from natural geologic hazards amount to tens of billions of dollars every year, and the cost of these losses continues to increase. A fundamental reason for this increase is the continued development of population centers and infrastructure in areas known to have significant natural hazards. Policy makers and public agencies at all levels of government must balance the desired needs for community growth and development with concerns for ensuring the safety of the citizenry. Knowledgeable professionals must provide government decision makers, community planners, and developers with factual, timely, and unbiased scientific and engineering assessments of a community's vulnerability to geologic hazards. Planning scenarios have proven to be an effective means for communicating these risks.

Earthquake Planning Scenarios have been prepared for several areas in the western U.S. over the past two decades and have resulted in numerous initiatives to reduce future earthquake losses (see Appendix 1). A planning scenario describes a realistic earthquake and the estimated resulting damage and casualties in the affected areas. It may describe the fault rupture that initiates the earthquake, expected ground motion and acceleration, secondary effects triggered by the earthquake (landslides, liquefaction, surface rupture, tsunamis, fires), expected structural losses to the building stock and lifelines (major pipelines, power transmission lines, highways, bridges, airports, harbors, hospitals, etc.), and human casualties, as well as areas and types of infrastructure least likely to be damaged or destroyed. The purpose of a scenario is to provide accurate information that can assist governments and developers in engineering, planning, and protecting vulnerable facilities from the destructive effects of a future earthquake; prioritizing emergency relief operations in areas likely to suffer the greatest damage; or planning and conducting emergency response training exercises.

Appendix 1: Completed earthquake planning scenarios

Following the devastating eruption of Mount St. Helens in 1980, President Carter requested the National Security Council to consider the implications of the occurrence of a large damaging earthquake in California. The results of this analysis were presented by FEMA in 1981. One of the major conclusions was that it was unlikely that the collective emergency response capabilities of all levels of government and the private sector would be adequate to cope with a major destructive earthquake in metropolitan areas of California.

In response, the California Governor's Emergency Task Force on Earthquake Preparedness was established in February, 1981. Some 30 committees were formed to deal with improvement of the many emergency response functions that would be needed in such an earthquake emergency: e.g., communications, search and rescue, fire services, medical services, air transport, etc. Working with the Task Force, the California Geological Survey (CGS) developed the first two earthquake planning scenarios for the San Francisco Bay Area and the Greater Los Angeles Area. These two scenarios, funded by FEMA, were readily accepted, and a demand for additional scenarios covering other California metropolitan areas resulted in the production of five more scenarios over the following decade.

The State of Washington, through its Emergency Management Division of the Military Department, and the Earthquake Engineering Research Institute, recently prepared an earthquake disaster scenario for the Seattle-Tacoma metropolitan area. This scenario describes potential damage from the Seattle Fault, and predicts 1,600 deaths, 24,000 injured, police and fire departments overwhelmed, inadequate emergency and shelter services, nearly 40,000 buildings destroyed or rendered uninhabitable, $33 billion in damages and loss, more than 130 fires, and years of rebuilding and recovery.

In 1996, the Nevada Bureau of Mines and Geology (NBMG) produced a detailed scenario for a Reno-Sparks-Carson City earthquake. That scenario, published as NBMG Special Report 20, has been used numerous times in emergency response and recovery exercises, most recently in June 2008.

Most recently, the USGS, in collaboration with the California Geological Survey and many community agencies and organizations, has published *The ShakeOut Scenario – Effects of a Potential M7.8 Earthquake on the San Andreas Fault in Southern California* (USGS Open File

Report 2008-1150; CGS Preliminary Report 25). Under this scenario, if no additional preparedness and mitigation actions are taken, the resulting damage will cause 2,000 deaths, 50,000 injuries, and $200 billion in damage along with severe, long-lasting disruptions.

Other states with earthquake potential have also prepared these types of scenarios on a formal basis. Washington, in collaboration with the USGS, universities, and others, is undertaking studies of the potential damage from a very large earthquake along the Cascadia Subduction Zone. The California Geological Survey has considered this in one of its original scenarios. In 2007, Oregon completed an initial step in quantifying structures in the state that would be susceptible to damage from an earthquake in its publication *Statewide Seismic Needs Assessment Using Rapid Visual Screening.*

In Alaska, an earthquake planning scenario is in the initial stages of development for the Kodiak area. This scenario is a cooperative effort involving the Alaska Seismic Hazards Safety Commission, Alaska Division of Homeland Security & Emergency Management, city and borough government, FEMA, and U.S. Coast Guard.

Appendix 2: Resources for scenario development

Valuable analytical tools are available for incorporation into Earthquake Planning and Mitigation Scenarios. HAZUS is a powerful risk assessment software program developed by FEMA for analyzing potential losses from earthquakes (as well as from other types of natural hazards). HAZUS combines current scientific and engineering knowledge with geographic information systems (GIS) technology to produce estimates of hazard-related damage before or after an earthquake. For HAZUS to be most effective, users should employ the latest census information and a current inventory of the built environment, including transportation and lifeline infrastructure.

Two other analytical tools are available from the USGS; these are ShakeMap and PAGER. ShakeMap combines measurements of ground shaking (actual or modeled) with information about local geology and earthquake location and magnitude to estimate shaking variations within a geographic region. Produced maps are a valuable tool for emergency response, public information, loss estimation, earthquake planning and modeling, and post-earthquake engineering and scientific analyses.

PAGER (Prompt Assessment of Global Earthquakes for Response) is an automated system designed to rapidly estimate the number of people, cities, and regions that have been exposed to severe ground shaking by an earthquake. PAGER products can be sent automatically to affected emergency responders, government agencies, and others with information as to the estimated scope of a potential disaster.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 12-2

Developing Earthquake Risk-Reduction Strategies

Policy Recommendation 12-2

WSSPC strongly encourages states and local governments to develop and continually update long-term, comprehensive statewide and community-level earthquake risk-reduction strategies as part of an all-hazards plan to reduce injury, loss of life, property damage and economic disruption from earthquakes.

Executive Summary

Given the high seismic activity in the western states, provinces and territories, and the high risk of loss of life, property damage and economic loss due to earthquakes, state and local governments are encouraged to form public-private partnerships that will develop earthquake risk-mitigation plans and risk-reduction strategies that will benefit local communities. Mitigation policies and activities are long-term, multifaceted processes where effective coordination, collaboration and communication among partners are critical. For example, partnerships with the many Seismic Safety Boards and Commissions that have been created in WSSPC states are critical in the effort to educate state and local policymakers about the importance of sound seismic hazard policy.

Background

Given the high seismic activity in the western United States, Pacific territories, and Canada, mitigation of earthquake risks is a common interest among all the western states, territories, and provinces. FEMA's Report 366b, (April 2008), *HAZUS-MH Estimated Annualized Earthquake Losses for the United States*, clearly shows that the western states are most at risk, with 84% of the nation's estimated annual dollar losses from earthquakes. WSSPC, as a consortium of 13 western states, 3 Pacific territories, and a Canadian territory and province, is the ideal organization to promote the benefits of earthquake risk-mitigation policies, to promote collaboration among its members and the federal government, and to share mitigation successes between WSSPC and other organizations. From its inception, WSSPC has strongly supported reduction of losses from seismic events through policy recommendations and annual conferences.

The benefits of proper mitigation and planning is highlighted by cost/ benefit studies that show for every FEMA dollar spent on mitigation, four dollars are saved in reduced disaster relief. In addition, FEMA grants to mitigate natural-hazard risks are expected to save lives and injuries in future events (Multihazard Mitigation Council, 2005, *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities*).

It is the responsibility and duty of the geological and emergency management community to organize and disseminate key information concerning proper earthquake-risk mitigation. WSSPC encourages its partners to seek potential mitigation outreach activities, mitigation plan development, or construction projects, some of which may be eligible for funding through FEMA's various mitigation program grants. These efforts complement FEMA's Pre-Disaster Mitigation initiatives.

Comprehensive statewide and local earthquake mitigation plans and strategies should include the following elements:

- Assessment of all seismic hazards to quantify and define the risk to communities;
- Assessment of infrastructure risks;
- Implementation of land-use and development policies to reduce exposure to earthquake hazards;

- Adoption and enforcement of the International Building Codes for the seismic design, inspection, and construction of new buildings and structures;
- Adoption of the International Existing Building Code for the maintenance and retrofit of seismically “at risk” structures;
- Development and implementation of retrofit, redevelopment, grant, and abatement programs to help strengthen existing structures, where necessary;
- Support of continuing public-education efforts and public/private partnerships to raise awareness of seismically induced threats and build constituent support for earthquake hazard reduction programs.

Safety of communities and infrastructure can only be accomplished though diligent, informed, and coordinated efforts of regulators and stakeholders. WSSPC will continue to play a key role in that organization and communication effort.

Appendix A: WSSPC Member State Implementation of Policy Recommendation 12-2

Washington: The Resilient Washington State Initiative is a strategic planning process for achieving state-level resilience with respect to earthquake hazards. The intent of the process is to identify actions and policies before, during, and after an earthquake that can leverage existing policies, plans and initiatives to realize disaster resilience to earthquakes within a 50-year life cycle.

Subsection D-5

History of WSSPC Policy Recommendations: 1997-2014

History of WSSPC Policy Recommendations
1997-2014

Adoption Status	Title	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PR 14-1	Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources			A 99-1	>>>>>	>>>>>	R 02-1	>>>>>	>>>>>	R 05-1	>>>>>	>>>>>	R 08-1	>>>>>	>>>>>	R 11-1	>>>>>	>>>>>	R 14-1
PR 14-3	Earthquake Monitoring Networks	A 97-4	>>>>>	>>>>>	>>>>>	>>>>>	R 02-5	>>>>>	>>>>>	R 05-3	>>>>>	>>>>>	R 08-3	>>>>>	>>>>>	R 11-3	>>>>>	>>>>>	R 14-3
PR 14-4	Identification and Mitigation of Unreinforced Masonry Structures					>>>>>							A 08-4	>>>>>	>>>>>	R 11-4	>>>>>	>>>>>	R 14-4
PR 14-5	Earthquake Emergency Handbook for First Responders and Incident Commanders															A 11-5	>>>>>	>>>>>	R 14-5
PR 14-7	Earthquake Early Warning Systems														A 10-9	>>>>>	>>>>>	W	R 14-7
PR 13-1	Rapid Tsunami Identification and Evacuation Notification					A 01-1 & 01-2	>>>>>	>>>>>	R 04-1 & 04-2	>>>>>	>>>>>	R 07-1 & 07-2	>>>>>	>>>>>	R 10-1 & 10-2	>>>>>	>>>>>	R 13-1	>>>>>
PR 13-3	Post-Earthquake Technical Clearinghouses					A 01-3	>>>>>	>>>>>	R 04-3	>>>>>	>>>>>	R 07-3	>>>>>	>>>>>	R 10-3	>>>>>	>>>>>	R 13-3	>>>>>
PR 13-4	Seismic Provisions in the 2012 International Building Code					A 01-4	>>>>>	>>>>>	R 04-4	>>>>>	>>>>>	R 07-4	>>>>>	>>>>>	R 10-4	>>>>>	>>>>>	R 13-4	>>>>>
PR 13-6	Post-Earthquake Information Management System											A 07-6	>>>>>	>>>>>	R 10-6	>>>>>	>>>>>	R 13-6	>>>>>
PR 13-7	Seismic Design of New Schools														A 10-7	>>>>>	>>>>>	R 13-7	>>>>>
PR 13-10	Joint Policy for the Evaluation and Seismic Remediation of School Buildings																	A 13-10	>>>>>
PR 13-11	Reliability of Lifeline Infrastructure																	A 13-11	>>>>>
PR 13-12	Earthquake Actuated Automatic Gas Shutoff Devices																	A 13-12	>>>>>
PR 12-1	Earthquake Planning Scenarios													A 09-1	>>>>>	>>>>>	R 12-1	>>>>>	>>>>>
PR 12-2	Developing Earthquake Risk-Reduction Strategies							A 03-1	>>>>>	>>>>>	R 06-1	>>>>>	>>>>>	R 09-2	>>>>>	>>>>>	R 12-2	>>>>>	>>>>>

Key: A = Adopted R = Re-adopted D=Discontinued N=Not Adopted W= Withdrawn/Returned to Committee

History of WSSPC Policy Recommendations
1997-2014

Adoption Status	Title	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
PR 11-2	Definitions of Fault Activity for the Basin and Range Province	A 97-1	>>>>>	>>>>>	>>>>>	>>>>>	R 02-3	>>>>>	>>>>>	R 05-2	>>>>>	>>>>>	R 08-2	>>>>>	>>>>>	R 11-2	>>>>>	>>>>>	W
D	Development of National Earthquake Hazard Risk Mitigation Priorities	A 97-3	>>>>>	>>>>>	>>>>>	>>>>>	D												
D	Developing Guidelines for Fault Trace Setbacks	A 97-2	>>>>>	>>>>>	>>>>>	>>>>>	R 02-4	>>>>>	>>>>>	D									
D	Building Safe and Strong to Reduce Vulnerability to Earthquakes through Partnerships and Code Adoption						A 02-2	>>>>>	>>>>>	D									
D	Priorities for Applied Research on Earthquake Hazards								A 04-6	>>>>>	>>>>>	D							
D	Supporting Non-technical Explanation of USGS Uncertainty Maps to Accompany Probabilistic Seismic Hazard Maps								A 04-7	>>>>>	>>>>>	D							
D	Identification and Potential Mitigation of Seismically Vulnerable School Buildings														A 10-8	>>>>>	>>>>>	N	
D	Basin and Range Province Earthquake Working Group(s)								A 04-5	>>>>>	>>>>>	R 07-5	>>>>>	>>>>>	R 10-5	>>>>>	>>>>>	D	
Proposed	To Reduce the Earthquake Vulnerabiity of Existing Public Buildings and Schools								N										
Proposed	Generic State Executive Order for Earthquake Safety for Existing State-Owned Buildings									N									

Key: A = Adopted R = Re-adopted D=Discontinued N=Not Adopted W= Withdrawn/Returned to Committee

SECTION E

2014 State, Province, and Territory Earthquake Program Reports

Alaska State Report

Alaska Division of Geological & Geophysical Surveys in Partnership with the University of Alaska Fairbanks Geophysical Institute and Alaska Seismic Hazards Safety Commission

The Alaska Division of Geological & Geophysical Surveys (DGGS) assisted in the preparation and organization of multiple demonstrations, commemorations, and field trips honoring the 50th anniversary of the Great Alaska earthquake of 1964. DGGS staff contributed to the program committees that organized the Seismological Society of America (SSA) and Earthquake Engineering Research Institute annual meetings in Anchorage and compiled the field trip guidebook for the 5th International Conference of IGCP 588 which focused on seismic influences on coastal change in Alaska. DGGS staff were interviewed and featured on a channel 2 news special segment on the 1964 earthquake titled "Unstable Ground".

In conjunction with the Alaska Gasline Development Corporation, DGGS conducted field work to assess seismic hazards along the intrastate natural gas pipeline corridor which is proposed to extend from Prudhoe Bay to Anchorage. Site-specific fault trenching studies were performed along the Castle Mountain fault, Minto fault, and Northern Foothills fault system to better characterize fault rupture parameters. Helicopter reconnaissance was performed to evaluate the presence or absence of Quaternary active splays along the Healy, Healy Creek, Stampede, and Park Road faults. Geologic hazards maps have been prepared for the entire alignment and the results from the 2011-2014 field programs are being compiled into a final technical report. Results from these field reconnaissance studies were presented at several national meetings including the Geological Society of America and Seismological Society of America.

DGGS geologist Rich Koehler continued to participate in collaborative tsunami research with the U.S. Geological Survey along the Aleutian subduction zone. This year's project on Sanak Island south of the town of Cold Bay utilized paleoseismic marsh coring techniques to collect samples for stratigraphic and geochronologic analyses that will be used to estimate tsunami recurrence. Koehler also continued collaborative efforts with the Alaska Earthquake Center at the University of Alaska Geophysical Institute to characterize tsunami hazards for priority communities in Alaska. This work is funded by the Alaska Division of Homeland Security & Emergency Management. Inundation maps and reports were published for the communities of Cordova, Tatitlek, Chenega Bay, and northern Sawmill Bay. Modelling efforts have been completed for the communities of Dutch Harbor, Sand Point, Gustavus, Elfin Cove, and Hoonah. Inundation maps and reports for these communities are in external peer review and are anticipated to be published in the near future. Results from these studies were presented at the annual meeting of the American Geophysical Union and at a workshop sponsored by the Port Alberni community and Ocean Networks Canada focused on tsunami detection in British Columbia. For the public outreach component of the tsunami inundation mapping program, DGGS held a public forum in Sitka to describe the maps to emergency managers and community members.

With support from the Alaska Office of Project Management and Permitting, DGGS staff conducted geomorphic and fault lineament mapping along the western Denali fault in the vicinity

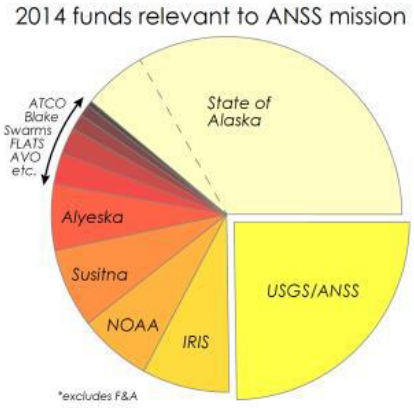
of the proposed Donlin Gold natural gas pipeline. The purpose of the study was to evaluate fault crossing design. DGGS geologists are reviewing field observations and reports presently being produced by geohazard contractors. Additionally, with support from the Alaska Office of Project Management and Permitting, State Pipeline Coordinators Office, and the Alaska Energy Authority, DGGS geologist Rich Koehler continued to provide technical review of the seismic hazard components for various infrastructure projects including potential power plant sites on Mount Spur, the west Susitna access road reconnaissance, and the Susitna-Watana hydroelectric project. DGGS staff have participated in discussions with the U.S. Geological Survey regarding the 2014 update of the probabilistic seismic hazard maps for Alaska.

In association with the Alaska Seismic Hazards Safety Commission (ASHSC), DGGS published the ASHSC annual report, which contains policy recommendations and supporting statements that reflect the goals of WSSPC. DGGS has initiated discussions with the ASHSC regarding the establishment of an earthquake clearinghouse for Alaska, the creation of an earthquake rapid response field guide specific to Alaska, and the establishment of an earthquake research program focused on vulnerable regions of the state. DGGS was present at the WSSPC annual meeting in Anchorage, Alaska and has actively participated in updating WSSPC policy recommendations.

Submitted by: Rich D. Koehler, Earthquake Geologist, Department of Geological and Geophysical Surveys.

University of Alaska Fairbanks Geophysical Institute

The University of Alaska Fairbanks Geophysical Institute (UAFGI) operates the Alaska Earthquake Center (*www.aeic.alaska.edu*), which is charged by the Alaska legislature with recording and archiving Alaska earthquake data and disseminating earthquake information to the public. The Earthquake Center also is a regional partner in the Advanced National Seismic System (ANSS), with reporting authority for Alaska.



Support for the Earthquake Center is divided about equally among the State of Alaska, federal agencies (USGS and NOAA), and targeted projects such as pipeline and dam monitoring. At left is a pie chart showing the breakdown of funding sources for work related to the ANSS mission.

Last year's fifty-percent reduction in NOAA funding for the Earthquake Center remains an ongoing concern. No other funds have become available for maintaining the 10 of the 18 seismic stations—most located in key remote locations—previously supported by NOAA.

Earthquakes in 2014

Between October 1, 2013 and September 30, 2014, the Earthquake Center reported a total of 43,473 seismic events in the state of Alaska and neighboring regions. The earthquakes ranged in depths from 0 to 296 km and in magnitudes from -0.4 to 7.9. Forty-one earthquakes had magnitudes of 5.0 or greater. About 20% of all earthquakes were located in the Aleutian Islands.

Overall, 2014 was an unusually active year for significant earthquakes in Alaska. The largest earthquake, of magnitude 7.9, occurred on June 23 in the Rat Islands. The earthquake was felt widely in the central and western Aleutians, with a maximum intensity of VI reported in Adak. The earthquake was located at 99km depth and occurred within the subducting Pacific Plate. We located over 1,000 aftershocks during the first week after the mainshock and 2,300 aftershocks through the end of September.

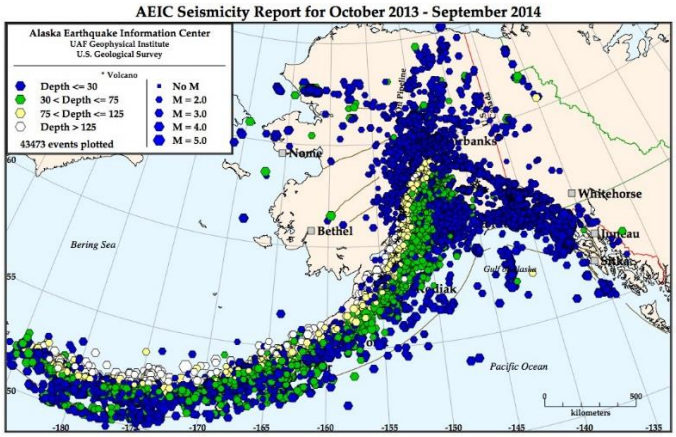
April and May included an unusual and energetic swarm in far northwestern Alaska, including five M5.8 events and hundreds of aftershocks. No structural damage was reported, but residents did report falling objects and cracks in walls and ceilings. We temporarily installed seismic stations in Noatak and Kotzebue to better capture this sequence.

On July 17, a magnitude 6 event in Canada was felt widely in Southeast Alaska. Eight days later, the magnitude 6.1 Palma Bay earthquake triggered a submarine landslide that severed an undersea fiber-optic cable, interrupting communications throughout Southeast, Alaska.

On August 31, a magnitude 5.1 earthquake near Minto was felt across the interior of Alaska and generated a vigorous aftershock sequence.

The largest earthquake in mainland Alaska during the reporting period was a deep magnitude 6.3 event near Skwentna on September 25. This earthquake was felt from Homer to Fairbanks and was felt very strongly in the Anchorage area, where it knocked pictures off walls, cleared items off shelves, and resulted in the evacuations of some downtown buildings. Intense media and public interest followed this earthquake.

The map below shows all located earthquakes, color-coded by depth and scaled according to magnitude:



Field Work

The USArray redeployment to Alaska has allowed our field efforts to shift away from network expansion and focus instead on improving and hardening existing stations. 2014 improvements included larger, re-designed solar arrays at several sites, improved telemetry for our crucial, remote Bering Glacier network, and direct-burial of sensors at sites where seismic vaults have provided noisy data. Earthquake Center field personnel also worked extensively with Incorporated Research Institutions for Seismology (IRIS) staff on stations that are being adopted into the USArray.

USArray

The 2014 field season marked the beginning of field operations for the Transportable Array (TA) redeployment to Alaska. Eleven existing sites in our network were upgraded with new sensors and in some cases improved borehole sensor installations. This is in addition to nine new TA sites installed in Alaska. Earthquake Center staff members were involved in all aspects of this work. Two Earthquake Center staff members continue to work full-time on USArray permitting and outreach work, while a third participates in field operations.

Inundation Mapping

As part of the National Tsunami Hazard Mitigation Program (NTHMP), UAFGI and ADGGS continue their collaboration on tsunami-inundation mapping projects with funding from NOAA through ADHSEM. A report for Sitka including tectonic and landslide sources was published in November 2013 and reports for Cordova, Tatitlek, and Chenega were published in 2014. Reports for Akutan, Unalaska, Elfin Cove, Gustavus, and Hoonah have been submitted to ADGGS for publication. Modeling has been completed for Sand Point and Yakutat, and those reports are in progress.

Other Projects

Other current UAFGI earthquake-hazards research projects include:

- Development of catalog of moment tensors based on full waveform inversion.
- Testing of the MT-GRID algorithm for real time moment tensor inversion.
- ShakeMap production for all significant Alaska earthquakes.
- Seismic monitoring of the Trans Alaska Pipeline through strong motion and broadband instruments at 11 sites along the pipeline corridor, including generation of threshold alarms and ShakeMaps.
- Seismic monitoring of the Bradley Lake Hydroelectric Project.
- Seismic monitoring of the proposed Susitna-Watana Hydroelectric Project as part of the FERC permitting process.
- A new, multi-year research project studying the Minto Flats Seismic Zone. UAF professor Carl Tape is the PI, and the Earthquake Center is providing administrative and technical support.

Submitted by: Mike West, Director, Alaska Earthquake Information Center, UAFGI.

Alaska Seismic Hazards Safety Commission

Highlighting the year, the Alaska Legislature passed and the Governor signed Senate Bill 137 reauthorizing the Alaska Seismic Hazards Safety Commission through 2020. As an advisory body charged to recommend goals, priorities, and policies for mitigating seismic hazards, the Commission's work in 2014 continued to focus towards long-term goals to improve the safety of schools and public buildings at risk from earthquake damage; facilitate local earthquake scenario planning studies; and educate State government and public entities about the Alaska seismic environment.

During 2014 the Commission maintained a full roster of 11 members, comprised entirely of volunteers representing the fields of civil, structural and geotechnical engineering, geology, seismology, emergency management and response, local government, and insurance. We welcomed one new commissioner appointed in 2014: Jonathan Owen, the Director of Public Safety for the City of Palmer. Through October the Commission had conducted four half-day and two two-day meetings (a half-day meeting is also scheduled in December). The Commission's principal efforts and accomplishments during the year included:

- Initiated a pilot program, funded through EERI, to test *Rapid Visual Screening* methods for qualifying the seismic vulnerability of several schools in the Matanuska-Susitna School District. The results of this pilot program will be used to support planning and funding for larger scale projects aimed at identifying and prioritizing seismically vulnerability schools and public buildings throughout Alaska (similar to the successful programs recently completed in Oregon and Utah).
- Continued work on a scenario earthquake study for eastern Kodiak Island (devastated by tsunamis generated during the 1964 M9.2 Great Alaska Earthquake); including assisting FEMA complete a HAZUS risk assessment for the project.
- Continued work on a white paper summarizing the known earthquake sources and seismic environments across the state.
- Prepared a position paper discussing the practical pre- and post-earthquake benefits to the owners and the public from having seismic instrumentation in critical facilities. To date the position paper has been sent to 12 State, local government and private entities responsible for critical buildings, bridges, airports and industries.
- Presently, Alaska's building code follows the 2009 IBC and will likely not adopt the 2012 IBC until 2015 or 2016. Therefore, the Commission prepared a position paper to the Alaska departments of Education and Early Development, Public Safety, and Transportation & Public Facilities recommending they require the design of publically-funded buildings follow the seismic provisions of the 2012 IBC, which are more relevant to Alaska than the 2009 IBC, until such time as the State adopts that edition.
- Approved and implemented *Policy Recommendation 14-1* recommending the Alaska Department of Natural Resources develop a post-earthquake response and investigation field guide for conducting post-earthquake field investigations, coordinating geoscience activities with other emergency response entities, and reporting investigation results.
- Prepared a guide to help communities complete a concept-level earthquake scenario study as a means to qualify, using existing resources, the more likely types of geologic

hazards and extent of local ground failures, improve local long-term development and emergency response planning, and to determine the need for and/or support of a more extensive full-scale scenario study.

Additionally, individual commissioners: (i) continued to participate in other groups directly involved with the mitigation of seismic hazards (e.g. WSSPC committees, and the Municipality of Anchorage Geotechnical Advisory Commission); (ii) participated on the EERI national and local organizing committees for the 10th National Conference on Earthquake Engineering, held in Anchorage during July; and (iii) presented several lectures as part of a summer program in Anchorage commemorating the 50th anniversary of the 1964 M9.2 Great Alaska Earthquake, sponsored by the USGS and NPS, discussing the impacts and effects of that earthquake today.

Submitted by: Robert L. (Buzz) Scher, Chair, Alaska Seismic Hazards Safety Commission.

Arizona Geological Survey

During 2014, the Arizona Geological Survey (AZGS) cataloged over one-hundred Arizona earthquakes, including an Mw 5.3 event in the eastern part of the state. AZGS also participated in multiple outreach activities, including a Great Shake Out event this past October. AZGS' up-to-date earthquake catalog can be view at: *http://data.azgs.az.gov/hazard-viewer/*

A magnitude 5.3 earthquake occurred near Duncan, Arizona at approximately 10 pm on June 28th, 2014, a (Figure 1). The earthquake shaking was strong and caused moderate damage in the Duncan area; it was felt throughout southeastern Arizona and was recorded by seismometers around the globe. The earthquake began about 7 km below the surface, and we have found no evidence that the earthquake ruptured the earth surface. This was the largest earthquake that has occurred in southeastern Arizona – southwestern New Mexico in 75 years, and it serves as a reminder that Arizona does indeed have earthquakes and earthquake hazards.

There have been hundreds of aftershocks, most of which were too small to detect with the permanent network; however, an Mw 4.1 quake occurred about 3 weeks after the mainshock. AZGS deployed 6 temporary stations surrounding the area of the mainshock to better locate events, and hopefully, help us determine what the type and orientation of the faults are in the region. Due to a lack of funding and the high volume of data generated by the temporary network, analysis is still forthcoming.

Figure 1. Google Earth image (oriented with north pointing up); the Mw = 5.3 earthquake located on the east side of the Peloncillo Mountains, the town of Duncan in the north-central part of the image, and the six temporary stations (TOM, DUN1-5).

Submitted by: Jeri J. Young, Research Geologist, Arizona Geological Survey

Emergency Management British Columbia

BC Earthquake Planning

Emergency Management British Columbia (EMBC) has made a commitment to British Columbians to develop a long-term plan that articulates provincial goals regarding catastrophic earthquake preparedness, and a phased approach for achieving these goals. An integrated, BC Earthquake Planning Team has been brought together and is currently drafting the Immediate Response Phase to the BC Earthquake Plan to be completed by spring 2015. The additional phases include Sustained Response and Recovery and will be completed in 2016 and 2017.

BC Earthquake Consultations

The Earthquake Preparedness Consultation was announced by British Columbia's Attorney General and Minister of Justice on March 11, 2014, with the objective to engage with BC stakeholders to gather feedback regarding earthquake preparedness issues and priorities. The Chair was instructed to consider this feedback and provide recommendations to government on how British Columbians could improve their preparedness for a catastrophic earthquake. Consultations, conducted during the April to July 2014 period, engaged with a wide variety of stakeholders both within and outside of government. The Chair's report will be provided to the Minister by December 31, 2014.

ShakeOut

The BC Earthquake Alliance annually organizes the province-wide earthquake drill, held on the third Thursday in October, to enhance awareness of the earthquake hazard in BC and encourage personal preparedness. During the Great British Columbia ShakeOut, participants are asked to "Drop, Cover and Hold On" in response to a simulated earthquake event. The ShakeOut BC drill coincides with ShakeOut drills across the globe. This year over 740,000 participants registered to take part in the Great British Columbia ShakeOut drill.

BC Seismic Safety Council

Co-chaired by EMBC and Natural Resources Canada, this group of federal, provincial and academic representatives has been developed to integrate province-wide strategies that address seismic concerns in areas including: tsunami planning levels, education and outreach, earthquake early warning system and risk assessment tools.

Tsunami Notification Networking Group

EMBC chairs an integrated Tsunami Notification Networking Group, comprised of federal, provincial and academic partners that meet regularly to share information regarding updates to tsunami notification procedures and lessons learned to ensure coordination interdepartmentally and with the province of BC**.**

Tsunami Notification Tests

Regular tests of the Provincial Emergency Notification System (PENS) are conducted to ensure readiness for a distant tsunami event that may impact the British Columbia coastline. During these tests, approximately 1100 phone calls are made via the Interactive Voice Response (IVR) system, as well as 300 faxes and 300 emails to local governments, local emergency officials, police and fire departments, federal and provincial ministries, First Nations, utilities, regional health authorities and the media.

Earthquake and Tsunami Outreach

In 2014, EMBC travelled to coastal communities to connect with local governments about tsunami notification and share enhancements to the tsunami notification process resulting from lessons learned from the October 2012 Haida Gwaii earthquake and tsunami events. A public education campaign followed in the spring of 2014 to coincide with the commemoration of the 1964 Great Alaska earthquake and tsunami.

International Working Group Participation

In addition to being a member of WSSPC, EMBC holds a seat on the Executive Board of the Cascadia Region Earthquake Workgroup (CREW), attends the annual National Tsunami Hazard Mitigation Program and participates on NOAA's Warning Coordination Subcommittee. EMBC is also engaged with FEMA and Washington Military Department Emergency Management Division in the planning of the 2016 catastrophic earthquake and tsunami exercise, Cascadia Rising.

Submitted by Kathryn Forge, Seismic Specialist, Emergency Management British Columbia.

California Geological Survey

Seismic Hazards Zonation

Under this program are three major projects. The first is authorized by the Alquist-Priolo Earthquake Fault Zoning Act, in which active faults (as defined by the State Mining and Geology Board as having movement in the Holocene – approximately the last 11,000 years in California) are zoned where they express surface rupture. Construction of structures for human habitation within these regulatory zones generally is prohibited. CGS has zoned over 5,000 miles of active surface faults in the State, producing about 553 maps. It is estimated that approximately 1,800 miles of active surface rupture remains to be zoned.

The mapping of other seismic hazards is authorized by the Seismic Hazards Mapping Act. This project places zones around the extent and likelihood of secondary hazards following an earthquake, such as ground liquefaction and triggered landslides, in urbanized areas. Under this project, 115 maps have been produced covering over 7,000 square miles. These maps are regulatory in nature and enforced by local permitting agencies. CGS continues to map in several areas around the state.

Work continued on the joint CGS-California Office of Emergency Services Tsunami Hazard Mitigation and Preparedness Program. Funded by grants through the National Oceanic and Atmospheric Administration and the Federal Emergency Management Agency, this program works with experts at the University of Southern California, Humboldt State University, State Lands Commission, and URS Corporation to develop new tsunami hazard preparedness maps and products for emergency managers, maritime communities, and land-use planners. Tsunami evacuation "playbook" maps have been completed for Humboldt, San Francisco, Monterey, Ventura, Orange, and San Diego counties to help emergency managers improve their plans and response to minor to moderate size tsunami events. Tsunami current velocity maps and maritime response "playbooks" are being generated statewide to help harbors and ports plan and respond to tsunami scenarios of various sizes and duration. Production of second-generation probabilistic tsunami hazard analysis (PTHA) maps and associated products are being completed for Del Norte, Humboldt, San Diego, and Orange counties that will form the basis for new zones of required investigation under the Seismic Hazard Mapping Act. These new zone maps will help community land-use planners evaluate new coastal development projects for their tsunami risk and help mitigate those risks. CGS also works with other state and federal tsunami programs through the National Tsunami Hazard Mitigation Program (NTHMP) to help vet these new products. CGS, which holds a leadership role as the state co-chair of the NTHMP Mapping and Modeling Subcommittee, has taken the lead in developing guidance for other states to produce similar mapping products so that tsunami hazard planning can be done accurately and consistently across state boundaries.

Seismic Hazards Assessments

The construction of new schools, or when structural modifications are made to existing schools, requires a permit from the Division of the State Architect. Prior to the issuance of a school construction permit, CGS reviews consulting reports describing the school site's geology and seismic hazards to ensure that those hazards, if any, are adequately

described and taken into consideration in the construction of the school. Failure of a school district to thoroughly and adequately evaluate existing seismic hazards will prevent the school from receiving site approval from CGS and a construction permit from the State Architect. CGS reviews reports from approximately 400 school sites each year, and makes field checks of sites where fault trenches are exposed. Also under this program, CGS evaluates the seismic hazards site conditions for hospital construction for the Office of Statewide Health Planning and Development Safety Board (OSHPD). Hospitals must be constructed in strict accordance with OSHPD standards. CGS reviews consulting reports from approximately 70 hospital sites each year. Earthquake risk and loss assessments also are conducted under this program, wherein local and regional damages to the infrastructure are calculated and analyzed for various earthquake scenarios along major fault systems.

Strong Motion Instrumentation Program (SMIP)

This earthquake engineering program commenced in 1971 and has evolved into the largest Strong Motion Network in the nation, with over 1,250 stations and more than 8,900 instruments installed in 64 bridges, 80 hospitals, 230 buildings, 39 geotechnical arrays, and 880 free-field stations throughout the State. Strong motion information gathered by this network is provided to the structural engineering and design communities to improve the earthquake resiliency of California's structures. Ultimately, this information is incorporated into the Building Code. The CGS SMIP network comprises the largest part of the California Integrated Seismic Network (CISN), along with networks and partnerships with the USGS, California Office of Emergency Services (CalOES), Caltech and UC Berkeley. CISN is an integral part of the USGS Advanced National Seismic System (ANSS).

The SMIP is in partnership with the USGS in the operations of the Center for Engineering Strong Motion Data (CESMD). Strong motion data from throughout the U.S. and from around the World are sent to the Center for processing, display, and archiving. Data arriving from the CISN system is automatically processed and offered on the Internet within minutes of an earthquake event. Earthquake data from different parts of the World may take several days to post because of some countries' data holding policies. The Center's archives may be accessed at: *http://strongmotioncenter.org/*.

This year, some of the SMIP projects included completing the placing of hundreds of instruments (accelerometers) on the East Bay extension of the San Francisco Bay Bridge which was recently opened to traffic, and placing over 40 hardy, autonomous strong motion recorders along high-likelihood faults in Southern California, to address the need for more strong motion data close to faults. Numerous hospitals and other structures were also instrumented.

Earthquake Early Warning System

In late August, 2013 the California Legislature passed Senate Bill 135 (Senator Padilla), that authorized the State of California to develop and implement an Earthquake Early Warning System. Under this Act, the California Office of Emergency Services, acting in cooperation with the California Geological Survey, California Institute of Technology, University of California (Berkeley), Alfred E. Alquist Seismic Safety Commission, and the U. S.

Geological Survey, is to oversee the planning and implementation of the System. Several organizational meetings have been held, and the physical planning commenced in January, 2014, with full designs and funding for implementation completed by January 2016.

California Governor's Office of Emergency Services And Partner Agencies

About Cal OES and Partner Agencies

Under the authority of the California Emergency Services Act (Government Code Section 8550 et seq.), the Governor's Office of Emergency Services (Cal OES) coordinates all State emergency planning and preparedness, disaster response and recovery, disaster mitigation, and homeland security activities. The agency mission is to protect lives and property, build capabilities, and support our communities for a resilient California. The mission is achieved through effective collaboration in preparing for, protecting against, responding to, recovering from, and mitigating the impacts of all hazards and threats.

The Cal OES Earthquake and Tsunami Program consist of six core staff members who are dedicated to serving the public through partnerships with federal, state and local agencies, universities, networks and associations, voluntary organizations and the private sector. The staff is comprised of an earthquake program officer and coordinator, tsunami program officer and coordinator, program manager and an associate program assistant. This core staff leverages the agency's charge to manage an earthquake and tsunami preparedness and response program by effectively cooperating with its network of partner agencies.

The Cal OES Earthquake and Tsunami Program is an active participant on boards and committees as well as in professional associations involved with disaster preparedness. Program staff participates in Board of Directors meetings for the Western States Seismic Policy Council (representing the Cal OES Director), the Cascadia Region Earthquake Workgroup, the External Advisory Board of Southern California Earthquake Center, and the External Advisory Board of the Federal Alliance for Safe Homes.

In addition to board participation, Program staff has held leadership positions in: the California Tsunami Steering Committee (Chair), the Coordinating Committee of the National Tsunami Hazard Mitigation Program, the California Integrated Seismic Network Steering Committee, and the California Post-Earthquake Clearinghouse Management Committee.

Earthquake, Tsunami and Volcano Hazards

California sits on the juncture of two major tectonic plates, the North America Plate and the Pacific Plate. The San Andreas fault generally parallels the coast in a southeasterly direction, coming ashore near Eureka, passing west of San Francisco and east of Los Angeles into Mexico. The associated seismic activity contains the potential for more than seventy four percent of the country's overall expected annualized losses (FEMA 3666, 2008).

In the past two centuries, earthquakes have claimed the lives of more than 3,000 Californians. Currently, approximately 30 million residents are exposed to significant risk for damaging 2014 earthquakes. In addition, the state attracts 200 million visitors every year, largely to areas at risk for catastrophic earthquake.

Of the 58 county operational areas, 20 have exposure to the potential for tsunami damage. This includes 99 coastal cities, three metropolitan areas with major harbor facilities and approximately 376,000 people living in mapped tsunami inundation zones. The population does not include the several million visitors who are attracted to the beach every year.

The state's population, infrastructure and economy are also vulnerable to the threats posed by volcanic activity. The United States Geological Survey (USGS) Volcano Observatory suggests there is a high to very high threat potential from seven volcanic fields, centers, chains, craters and calderas. Three more pose a moderate threat potential.

Earthquake Activity in 2014

As of this writing the USGS reports that 72 earthquakes of Magnitude 3.5 or greater have occurred in the state since January 1, 2014. Twenty-six of those were of M4.0 or greater. Of those, one was in the M5.0 range and two were in the M6.0 range.

The Magnitude 5.1 La Habra Earthquake occurred on March 28, 2014 and resulted in damage and emergency responses in Orange and Los Angeles Counties. Local Emergencies were proclaimed, but the losses did not result in a state or federal declaration.

A M6.8 earthquake occurred in the ocean 78km WNW of Ferndale, California on March 10, 2014 (Gorda Plate / Triple Junction area). While the temblor was near enough to the coast to be felt by local residents, no significant damage was reported.

Most recently and most significantly, the M6.0 Napa Earthquake on August 24, 2014 resulted in one death and caused more than $87 million in public losses. Some reports estimate the total public and private losses to be closer to $1 billion. Local Emergency Proclamations and requests for state assistance were received from Napa and Solano Counties. Governor Brown proclaimed a State of Emergency for the Napa Earthquake on August 24, 2014. President Obama declared the Napa Earthquake to be a Major Disaster on September 11, 2014.

Since 1971 there have been 12 other notable earthquakes that have generated direct losses, deaths and injuries. These include the M6.6 San Fernando earthquake on February 9, 1971, M6.5 Imperial Valley Earthquake on October 15, 1979, M6.5 Coalinga Earthquake on May 2, 1983, M6.0 Whittier Narrows Earthquake on October 1, 1987, M6.9 Loma Prieta Earthquake on October 17 1989, M7.0 Cape Mendocino Earthquake on April 25, 1992, M7.3 Landers/Big Bear Earthquake on June 28, 1992, M6.7 Northridge Earthquake on January 17, 1994, M7.1 Hector Mine Earthquake on October 16, 1999, M7.1 San Simeon Earthquake on December 22, 2003, M6.5 Eureka/Humboldt Earthquake on January 9, 2010, and M7.2 El Mayor Cucapah Earthquake on April 4, 2010.

Exhibit 1: Recent Earthquakes with Direct Losses, Deaths and Injuries

Earthquake	Date	Magnitude	Direct Losses[a]	Deaths[d]	Injuries[d]
San Fernando	February 9, 1971	6.6	$2,200[b]	58	2000
Imperial Valley	October 15, 1979	6.5	$70[b]	0	91
Coalinga	May 2, 1983	6.4	$18[b]	1	47
Whittier Narrows	October 1, 1987	6.0	$522[c]	9	200+
Loma Prieta	October 17 1989	6.9	$10,000[d]	63	3757
Cape Mendocino	April 25, 1992	7.0	$80[c]	0	356
Landers/Big Bear	June 28, 1992	7.3	$120[c]	1	402
Northridge	January 17, 1994	6.7	$46,000[b]	57	11,846
Hector Mine	October 16, 1999	7.1	minor	0	11
San Simeon	December 22, 2003	6.5	$263[e]	2	46
Eureka/Humboldt	January 9, 2010	6.5	$43	0	43
El Meyor Cucapah	April 4, 2010	7.2	$91	0	91

[a] *Estimate in millions of dollars*
[b] *FEMA, 1997; U.S. Office of Technology Assessment*
[c] *National Research Council, 1994*
[d] *Cal OES*
[e] *CSSC 2004-02, 2004*

California Earthquake Prediction Evaluation Council (CEPEC)

California Government Code Section 8657 establishes the California Earthquake Prediction Evaluation Council (CEPEC) to advise the Governor on the existence of earthquake or volcanic prediction having scientific validity. CEPEC was convened twice in 2014 at the request of either the State Geologist or the Cal OES Director.

On March 19, 2014, CEPEC was convened to discuss concerns about an apparent increase in earthquake activity throughout the State. Cal OES Director Mark S. Ghilarducci requested that the CEPEC assess the latest seismic activity and its potential impact to the State. Director Ghilarducci said that Governor Brown asked about the number of minor to moderate earthquakes that have occurred over the state in the past week.

Recent seismic activity of note through March 19, 2014 included:

- 3/10: M6.8 77km WNW of Ferndale in the Gorda Plate / Triple Junction area
- 3/12: M4.4 57km NE Kernville, CA
- 3/15: M3.9 near Castaic Lake Dam
- 3/16: M3.5 28km ENE of Pine Valley
- 3/17: M4.4 near Westwood, CA

The CEPEC Members concluded that that neither the M6.8 event off-shore of Ferndale on Monday, March 10, 2014, nor the M4.4 event near Westwood on Monday, March 17, 2014, was outside normal earthquake parameters.

On August 24, 2014, CEPEC again met by teleconference to discuss the circumstances of the M6.0 South Napa Earthquake and assess the implications for future damaging earthquakes that may occur in the vicinity.

A previous M4.9 event in the same area on September 3, 2000 resulted in no fatalities, 60 injuries, and minimal damage. On March 31, 1898 a M6.4 earthquake occurred on the nearby Rodgers Creek fault several miles to the west. The 1898 quake caused considerable damage to the Navy facilities at Mare Island. The San Francisco City Hall dome was also damaged.

CEPEC concluded that numerous aftershocks are typical in the days and weeks following an earthquake of this magnitude. While it is unlikely that any of these aftershocks will be larger than this morning's M6.1, there have been several examples in our past where a M6.0 was a foreshock to a larger event.

CEPEC stated that these events remind all Californians to be vigilant in their preparedness for earthquakes. People should be prepared for future aftershocks, which may cause additional damage to existing, damaged buildings. Residents should be prepared to not reenter structures until those structures have been inspected for structural soundness, natural gas leaks and water leaks. Now is a good time for residents to update their earthquake survival kits.

California Seismic Safety Commission

California Government Code Section 8690.45 provides for an Earthquake Emergency Investigations Account for the Seismic Safety Commission to enable them to investigate damaging earthquakes and fund investigation expenses. The commission also manages California's Earthquake Hazards Reduction Program and is charged to review seismic activities funded by the State as well as earthquake-related legislation.

After the Napa Earthquake the Seismic Safety Commission conducted public hearings to assess seismic safety issues and investigate earthquake damage and reconstruction efforts.

California Earthquake Clearinghouse

The California Earthquake Clearinghouse is a place to coordinate earthquake field investigations and share observations and knowledge among emergency responders and the engineering and scientific communities.

In response to the 2014 Napa Earthquake, the California Earthquake Clearinghouse provided a centralized coordination center where engineers, geologists, seismologists, sociologists, economists, and other professionals could coordinate the gathering of information, maximizing the use of its resources and capabilities. Responding engineers, inspectors and subject matter experts provided field observations that added valuable insights for use by officials managing response and recovery operations.

As part of the After-Action / Corrective Action analysis, the Clearinghouse identified the need to better coordinate NEHRP funding through state agencies so that operational priorities can be

centralized through each state. During the Napa event, funding issued directly to consortia members was used to meet consortia priorities, but their priorities were not always aligned closely with state response and recovery objectives.

2014 Earthquake, Tsunami and Volcano Preparedness Activities

In 2014, Cal OES coordinated earthquake, tsunami and volcano preparedness and response efforts with its partner agencies. Cal OES worked closely with the California Geological Survey (CGS), U.S. Geological Survey (USGS), California Seismic Safety Commission, California Earthquake Authority (CEA), Southern California Earthquake Center (SCEC) and Tsunami Research Center at USC, Caltech, University of California at Berkeley, American Red Cross; Earthquake Engineering Research Institute (EERI), Structural Engineers Association of California (SEAOC), local government, private industry, and non-profit entities, and California's Earthquake Country Alliance (ECA).

The Southern California Earthquake Center (SCEC) provides earthquake research and education as part of the outreach partnership. SCEC is a partner in UCERF, the California Earthquake Clearinghouse, and serves as the administrative "home" of Earthquake Country Alliance.

Other divisions of Cal OES involved in earthquake and tsunami mitigation and education include Mitigation Planning, Mitigation Grants, and Office of Communications.

2014 Great California ShakeOut

The Great ShakeOut earthquake drills that began in Southern California in 2008 have rapidly grown to be the world's largest preparedness activity. In 2014, a record ten million people and organizations participated in California alone.

Cal OES supported the Southern California Earthquake Center (SCEC) at the University of Southern California and the California Earthquake Alliance (CEA) to promote ShakeOut activities to improve ways that people can protect themselves during earthquake events. The recent South Napa Earthquake, the 20th anniversary of the '94 Northridge earthquake, and the 25th anniversary of the 1989 Loma Prieta earthquake are critical reminders that California is Earthquake Country.

Notable ShakeOut venues in 2014 included the Biola University and City of La Mirada Earthquake Drill (Southern California), the Loma Prieta 25th Anniversary Symposium and the 2014 Buildings-At-Risk (BAR) Summit.

Biola University / City of La Mirada Earthquake Drill

The drill was held as part of the ShakeOut events on October 16, 2014 that included a shake trailer simulations, interviews, press conference, and full-scale drill exercise with aftershocks.

Loma Prieta 25th Anniversary Symposium

The Loma Prieta 25th Anniversary Symposium: Still on Shaky Ground event was held on October 16 to commemorate the 25th anniversary of the 1989 Loma Prieta earthquake and support future resilience action. CalOES personnel served on the planning team as well as presenting and facilitating sessions. The symposium offered Bay Area residents and regional leaders an opportunity to inspire regional action for safer, more resilient communities. During the event, Bay Area leaders, community advocates, and elected officials launched a three-year public policy program designed to spark quick recovery from future disasters and enact place-based action for a safer future in the places we call home.

2014 Buildings-At-Risk Summit

Cal OES supported the 2014 Buildings-At-Risk (BAR) Summit: Strengthening Our Cities, presented by the Structural Engineers Association of Southern California (SEAOSC). The event convened over 300 engineers and other community leaders at The Center at Cathedral Plaza in downtown Los Angeles to talk about how to mitigate losses from a seismic event in Southern California, including potential liability issues and the official process for addressing its older, pre-1980 buildings.

Other ShakeOut Activities

As part of Cal OES support, staff coordinated with several local governments to promote and participate in ShakeOut events in both Southern and Northern California. Staff also developed copy and voiced a ShakeOut PSA sponsored by the Los Angeles County Professional Employees and coordinated with UC Berkeley to create an Earthquake Early Warning “ShakeAlert” model for use in a ShakeOut drill at the Loma Prieta 25th Anniversary Symposium. ShakeOut is further supported by the Federal Emergency Management Agency (FEMA), National Science Foundation (NSF), United States Geological Survey (USGS), and other sponsors.

Earthquake Country Alliance

This year Cal OES continued its support for the Earthquake Country Alliance by participating on several committees to promote earthquake preparedness. Activities included arranging speakers for the Los Angeles County long-Term Care Disaster Preparedness Summit, California Science Center media event regarding Volcano hazards in connection with their Pompeii exhibit, and an LA City business hazard mitigation and resiliency workshop.

The Earthquake Country Alliance is a public-private partnership of people, organizations, and regional alliances that work together to improve preparedness, mitigation and resiliency. Strategic Partner Organizations include California Governor’s Office of Emergency Services, United States Geological Survey, California Earthquake Authority, Southern California Earthquake Center, California Geological Survey, Federal Emergency Management Agency, American Red Cross, State Farm Insurance Company, and many others.

California Earthquake Authority

The California Earthquake Authority (CEA) is a publicly managed, largely privately funded organization that provides catastrophic residential earthquake insurance and encourages Californians to reduce their risk of earthquake loss.

The CEA provides significant in-kind support for ShakeOut and Earthquake Country Alliance, including hundreds of thousands of dollars of earned media donated to ShakeOut. This has provided Cal OES with the ability to leverage federal funds though co-funding of significant projects.

Through their partnership with ShakeOut and the Earthquake Country Alliance, the CEA has facilitated the publication of the Staying Safe booklets for public distribution. The CEA also partners with Cal OES to dispense household mitigation grants. The CEA continues to work closely with American Red Cross on the "Joined Forces" program. The CEA and Red Cross worked together to promote the annual Great California ShakeOut in October. The CEA also continued its support of federal legislation to lower rates and make earthquake insurance more affordable and accessible.

California Residential Mitigation Program

In 2014, Cal OES continued its coordination with California Earthquake Authority to implement an incentive program to help homeowners seismically retrofit their homes. The resources for this program, called the California Residential Mitigation Program (CRMP), come from the CEA Earthquake Loss Mitigation Fund. By statute, 5% of CEA's insurance premiums are used to support mitigation.

The program, called the Bolt + Brace Program, focuses on helping the retrofit of wood-frame family dwellings where those two specific elements are inadequate. The program has been piloted in two California Communities, the Los Angeles neighborhood of Eagle Rock and the Rockridge neighborhood of Oakland.

A typical retrofit can cost between $2,000 and $10,000. Earthquake Brace + Bolt will pre-qualify homeowners whose homes meet certain criteria and then select the recipients of the rebate (up to $3,000) using a database which will randomly select participants. The full program is projected to roll out in fall 2014.

NEHRP State Assistance Fund Administration

The loss of NEHRP State Assistance funding continues to inhibit the State's ability to be the leader in earthquake preparedness. Prior to Federal FY2012, Cal OES received and administered federal funding through the National Earthquake Hazards Reduction Program (NEHRP) to support earthquake preparedness in the state. However, beginning with FFY 2012 which dispersed funding in the 2nd quarter of 2013, FEMA no longer allocated NEHRP State Assistance Program funding to the states, but instead, to FEMA's Earthquake Consortia and other cooperative agreement holders. This change in policy impacts California most, since our risk is

(and funding was) highest among the NEHRP states. Since then, Cal OES has engaged the NEMA Mitigation Committee in support of State NEHRP priorities and management to restore funding administration to high-risk states in order to provide effective, coordinated earthquake preparedness programs. To further the cause, Cal OES has promoted stronger emergency management representation on NEHRP's Advisory Group, which is currently dominated by scientists/engineers. Their priorities are many times different than those of the emergency management community, which affects funding allocation decisions. Cal OES has recommended that FEMA consider involving other parts of their organization - beyond the Mitigation Directorate - in NEHRP in order to balance perspectives when it comes to setting NEHRP priorities.

On May 20-23, 2014, Cal OES staff represented California at the annual meeting of State Earthquake Program Managers (EPMs). Loss of state earthquake program functionality (due to loss of state NEHRP funding discretion) was discussed. Input from Alabama, Alaska and the NEMA executive board resulted in State EPMs organizing as a group for year-round coordination, along with the development of a White Paper on NEHRP funding and related issues.

In June and July, Cal OES staff worked with CUSEC staff and other National Earthquake Program Managers (NEPM) to create a survey of NEHRP state earthquake programs as support for developing a white paper regarding NEHRP and funding impacts on state earthquake programs. Staff also participated in calls with FEMA and earthquake program managers from all 33 NEHRP states regarding submission of project recommendations for NEHRP 14 and 15.

California Integrated Seismic Network (CISN)

Cal OES supports the activities of the California Integrated Seismic Network (CISN) Steering Committee and the California Earthquake Early Warning System (CEEWS) Steering Committee in order to provide real-time earthquake monitoring and develop the capability to provide advance notification of seismic events.

Prior to 2000, with funding provided by FEMA, Cal OES, and USGS, three seismic monitoring systems operated by CGS, CalTech, UC Berkeley and USGS were integrated into a single seismic system. Under this arrangement, CGS provides scientific products and services about the state's geology, seismology and mineral resources and administers the California Strong Motion Instrumentation Program. UC Berkley conducts research on earthquake processes and earth structures and coordinates the Northern California Seismic Network to provide timely and accurate earthquake information. Cal Tech operates the Seismological Laboratory and coordinates the Southern California Seismic Network and serves as a focal point for earthquake information in Southern California. Other partners include Humboldt State University, which focuses its study on the Cascadia Subduction Zone and serves as a partner of the Redwood Coast Tsunami Work Group, promoting Earthquake and Tsunami education efforts.
Cal OES manages the funding contracts with three participating CISN institutions, CGS, UC Berkeley and CalTech. Since 2002, Cal OES has provided funding for the development and

maintenance of CISN at approximately $2-3 million per year. General Fund cuts in fiscal year 2011/12 reduced support for CISN to $1.7 million.

In 2014 Cal OES supported the efforts of the primary CISN partners in hosting the annual CISN Steering Committee meeting. This year's agenda focused on the evolving California Earthquake Early Warning System. The CISN advisory committee will review the CISN Strategic Plan and recommend revisions for the next planning period.

California Earthquake Early Warning System (CEEWS) Initiative

In 2014, the Cal OES Earthquake and Tsunami Program continued its collaboration with the California State Geologist, the Directors of the Seismological Laboratories at UC Berkeley and Caltech, the California and U.S. Geological Surveys and the California Seismic Safety Commission to promote the development of an Earthquake Early Warning System in California.

Timely warnings of an earthquake can provide seconds to minutes before the arrival of damaging shaking. Even a few seconds can allow time to take protective action such as taking cover in safe locations, stopping elevators and opening doors at the nearest floor, or automatically stopping critical processes to mitigate damages or to enhance public safety.

Several countries, including Japan and Mexico, have existing earthquake early-warning systems. In Japan, **i**nformation is transmitted to the public through a variety of mechanisms, including television and radio broadcasts, computer pop-ups featuring real-time maps showing the location of the epicenter and radiating seismic waves and text-style messages accompanied by an audible alert sent to cell phone users.

On September 24, 2013, Senate Bill 135, sponsored by Senator Alex Padilla, was signed into law by Governor Brown and codified as Government Code Section 8587.8. Under the law, Cal OES is tasked to develop a comprehensive statewide earthquake early warning system in California through a public-private partnership and identify funding sources, other than the State General Fund, by January 1, 2016.

The goal for this initiative is to rapidly detect the initiation of an earthquake, estimate the level of ground shaking to be expected, and issue a warning before significant ground shaking arrives.

Five objectives are established to meet the goal:

1. Develop an earthquake early warning model that represents a public-private partnership, and a cost effective and reliable system.
2. Formalize an earthquake early warning organization structure that incorporates existing roles and responsibilities, such as the CISN.
3. Establish performance standards and participation criteria for the application and operation of earthquake early warning components.
4. Develop guidelines for the public education about the system.
5. Develop funding options including a distributed funding model.

California has the foundation for an early warning system through the California Integrated Seismic Network (CISN) and the USGS "ShakeAlert" demonstration model. CISN allows for earthquake notification, location, magnitude and intensity of ground shaking in the form of a "Shake Map". Using real-time information gathered by a network composed of nearly 1,000 seismic stations in Southern and Northern California, CISN provides real-time information to develop maps and other products to assist emergency managers deploy resources to help protect lives and property in the areas hardest hit and rapidly determine the magnitude of the damage in order to qualify for federal assistance. CISN is a partnership among Cal OES, the California Geological Survey, the United States Geological Survey, the Caltech Seismological Laboratory and Berkeley Seismological Laboratory, with support from several contributing agencies and organizations.

The state is collaborating with a number of institutions, along with public agencies and the private sector, to assess current capabilities and resources to implement a system specific to California's unique needs. A series of committees are established to develop the plan. They include:

1. A Steering Committee comprised of public and private stakeholders and subject matter experts to review and provide advice on the progress of the other project committees as they work toward meeting the objectives. The steering committee is comprised of the chairs of the five committees and chaired by an executive level member of Cal OES.
2. A Stakeholder Liaison Group to inform and receive input on the development of the CEEWS external stakeholders and potential users of an earthquake early warning system during CEEWS development.
3. A Model Committee will develop a model that represents a public/private partnership that will operate in a cost effective and reliable manner. The Standards Committee and Model Committee are tasked with developing the system description for earthquake early warning in California.
4. A Standards Committee will ensure that the system operates in a timely, reliable and efficient manner.
5. A Management Committee will formalize an organizational structure that incorporates existing roles and responsibilities for seismic monitoring in California.
6. A Funding Options Committee will identify costs and options for system funding that do not identify the state General Fund as one of those sources.
7. An Education and Training Committee will identify the components of a comprehensive training and education program that addresses the needs of all potential users of an earthquake early warning system.

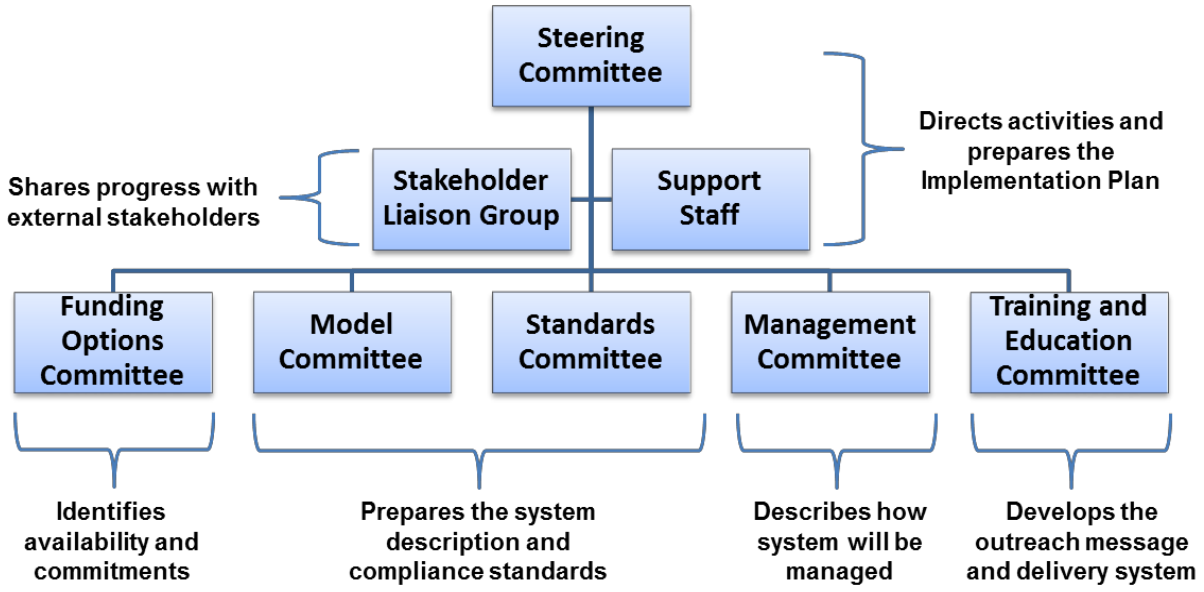
The Model Committee and Standards Committee are currently developing the system description which will outline the features and functions and performance requirements. The Management committee will contribute to the system description by defining how it will be managed and maintained. The Education and Training Committee will provide the outreach requirements.

In order to send earthquake early warning before shaking waves arrive will depend on five elements:

1. A network of sensors, which are densely and uniformly spaced, and situated in proximity to earthquake faults.
2. Quick, robust telecommunications from sensors with sustainable 24 hour coverage.
3. Computer algorithms for fast evaluation of seismic activity including location, magnitude, and potential for continued propagation.
4. Quick reliable mass notifications.
5. End user education.

A cost estimate for the system will need to consider construction costs for new installations, new or upgraded seismic stations and GPS stations, significant field telemetry upgrades, annual operation and maintenance, staffing costs for implementation and testing, operation and user outreach and continued research and development.

Exhibit 2: CEEWS Steering Committee Organization



A Project Charter has been developed to serve as a blueprint for developing an implementation plan for a California Earthquake Early Warning System. The charter identifies the project goals and objectives, outlines committee roles and responsibilities and establishes product timelines. The charter was published on February 21, 2014.

The Steering Committee agreed that a findings and recommendations report would be the appropriate format for summarizing the overall Steering Committee work. The recommendation for development of a technical implementation plan, including assignment to the appropriate agencies, could be included in the Steering Committee report. A draft Findings and

Recommendations Report will be prepared for presentation to the Steering Committee at the January 2015 meetings.

The CEEWS Implementation Plan will describe how the system will be developed, a time frame for implementation, an organization and management structure that clearly defines roles and responsibilities of public and private sector entities, conforms to performance standards that assure timeliness and accuracy of alerts, identifies and addresses user needs for training and education to effectively utilize alerts and provides a feasible and broadly consensual model for funding and maintaining the system. The draft Implementation plan is scheduled for presentation to the CEEWS Steering Committee in September 2015. In January 2016, the Steering Committee will convene to consider approving the final implementation plan.

Once the implementation plan is approved, each agency with a role in implementing the California Earthquake Early Warning System will develop its own work plans for developing and operating the system.

3rd International Earthquake Early Warning Conference

On September 3-5, 2014, Cal OES and partner agencies participated in the 3rd International Earthquake Early Warning Conference, organized and sponsored by UC Berkeley, USGS, CalTech, Moore Foundation and the University of Washington. Cal OES staff moderated a panel on the Public Use of Earthquake Early Warning.

The three-day meeting brought together scientists, policy makers, engineers, social scientists, and business representatives from public and private sector institutions to examine the state of the art in earthquake early warning today and to innovate new ways to push the technology forward.

Tsunami Preparedness

In 2014, the Cal OES Earthquake and Tsunami Program staff continued their coordination with CGS to support communities developing plans and programs to protect the public in the event of a future damaging tsunami. Cal OES and CGS staff has actively coordinated with government agencies and non-governmental organizations to promote an understanding of the tsunami risk in California. This program is made available through funding authorized by Public Law 109-424, 33 U.S.C. 3201 seq.: The Tsunami Warning and Education Act, 2006 (TWEA) and administered through the National Tsunami Hazard Mitigation Program (NTHMP). On March 27, 2014 a new bill, the Tsunami Warning and Education Reauthorization Act of 2014 was introduced in Congress, It reauthorizes the above Tsunami Warning and Education Act with specified appropriations for FY2015-FY2019 and expands the tsunami forecasting and warning program operated by the National Oceanic and Atmospheric Administration (NOAA), through the National Weather Service (NWS). This bill is currently pending in Congress.

The tsunami planning scenario is provided by the USGS Science Application For Risk Reduction (SAFRR) Program. The SAFRR Tsunami Scenario is based upon an earthquake offshore from the Alaskan peninsula and that extends to the California coast. This scenario integrates physical

science, social science and emergency management in creating detailed analysis to support officials and the public in reducing the risk of future tsunamis that will impact California.

According to the scenario approximately 750,000 people will need to be evacuated, with 90,000 of those being tourists and visitors. One-third of the boats in California's marinas could be damaged or completely sunk, resulting in $700 million in losses.

Tsunami Steering Committee

In 2014, Cal OES chaired and facilitated the Tsunami Steering Committee meeting held at San Francisco Airport. Steering Committee members include Cal OES, CGS, NOAA and 20 coastal county jurisdictional representatives. The Steering Committee reviewed a proposed maritime evacuation fathom policy and all California Tsunami Program priorities conducted within the state.

Tsunami Inundation Modeling

State tsunami modelers have completed all of the required modeling to validate 2nd generation tsunami inundation maps. Modeling and mapping tsunami inundation from a new large Aleutian Islands source developed by the USGS has been compared to the state inundation line. High resolution modeling (10m) in Orange and San Diego counties has been used to verify the inundation maps.

TsunamiReady Program

In 2014, the Cal OES Earthquake and Tsunami Program coordinated the delivery of Tsunami Signage as part of the TsunamiReady Program. Staff worked with the City of Alameda and Naval Base San Diego (NBSD) to develop their tsunami warning sign implementation plans. Several jurisdictions, including Mendocino County have placed a sign orders to implement their existing sign plan.

Tsunami Preparedness Month

In 2014, California continued to observe Tsunami Preparedness Week during the fourth week of March. The week is supported nationally by NOAA and is an opportunity for focused outreach and education at the community level. Cal OES facilitated assistance of a number of local activities, including:

- Proclamations by County Boards of Supervisors
- High-profile workshop presentations and the San Francisco Exploratorium, Long Beach Aquarium, Burton W. Chase Park Community Center in Los Angeles, and a media event at La Jolla Shores in San Diego.
- “Tsunami Walk” evacuation drills in Del Norte, Marin, San Francisco, Los Angeles, Orange, and San Diego Counties
- Governmental emergency management exercises in San Francisco, Marin, San Mateo, Orange, and Los Angeles Counties
- Participation in Tsunami Warning Communications Test (Del Norte, and Humboldt Counties)
- Participation in Required Monthly Test (Monterey, Oxnard, and San Diego NWS Weather Forecast Office areas of responsibility)
- Participation in PACIFEX14 (Marin, San Francisco, and San Mateo Counties)

- Discussion of development of Tsunami Preparedness Week Website (TsunamiZone.org)

During Tsunami week, the program has conducted a "Live Code" Tsunami Warning Communications Test which tests the operation and performance of the last critical link in the tsunami warning communications system—the Emergency Alert System that provides tsunami warnings to the public. This test uses the actual tsunami event codes that are used when a tsunami warning is issued by NOAA, a test few other states conduct due to the perceived risk that residents and visitors may mistake the test for an actual tsunami emergency. California has chosen to conduct this test to ensure that these EAS codes will function properly in an actual tsunami emergency.

Tsunami Modeling and Mapping for the Maritime Community

In 2014, the state continued its coordination with coastal jurisdictions to: 1) analyze risks to the maritime community 2) provide planning data and assistance for multiple scenarios to the emergency management community, and 3) work to produce probabilistic tsunami hazard analysis maps for the coast of California.

Cal OES and CGS staff assisted Base San Diego (NBSD) with incorporating evacuation Playbook, maritime Playbook, and FASTER decision support tools into NBSD operations plan. Staff participated in a Tabletop exercise with naval personnel involving a tsunami scenario.
Cal OES and CGS participated with the USGS and the City of Alameda to look at GIS modeling of vulnerability for Playbook phases, pedestrian and vehicular evacuation, and vertical evacuation analysis for Response planning purposes. State will facilitate coordination of project scope and eventual results with city.
Cal OES supported several coastal counties by reviewing and providing recommendations for editing tsunami evacuation annexes to their county emergency plans, including San Francisco and Marine counties. Staff worked with San Mateo County to explain the models used to derive the maximum tsunami run-up projections for the Princeton Harbor area. Staff also coordinated with Los Angeles County to provide tsunami evacuation lines for inclusion in the newly adopted Tsunami Annex to the Los Angeles County Response Plan.

Exhibit 3: Tsunami Playbooks Provide Decision Makers with Evacuation Alternatives

Concerns about Tsunami Warnings via Wireless Emergency Alerts (WEA)

NOAA's National Weather Service (NWS) is now able to activate Wireless Emergency Alert (WEA) capable cell phones for the most critical Tsunami Warnings. This will not include Tsunami Information Statements, Advisories, and Watches. This policy has caused concern in the emergency management community who believe the alerts will diminish public safety by taking away local decision authorities to order and manage mass evacuations.

Local emergency managers are recommending that NOAA provide local officials with the authority to issue WEA messages so there can be coordinated protective actions taken by the jurisdiction.

Ventura County submitted a letter to Cal OES requesting assistance in resolving the WEA message issue. Since then, Ventura County and National Weather Service officials have met to discuss the concerns.

NTHMP Annual Meeting

Cal OES participated in NTHMP annual meetings held January 27-31, 2014 in Menlo Park. The meeting discussed common issues of coordination among member state and territory partners, including:

- Tsunami Program Update
- NOAA Response to National Academy of Sciences Report
- TsunamiReady Update
- Evacuation Response
- Vertical Evacuation Update
- Marine Guidance Project Update
- NTHMP Member Accomplishments

Cal OES participated in the NTHMP Mitigation & Education (MES) and Mapping & Modeling (MMS) Subcommittee Meetings held August 18-22, 2014, in Seattle, Washington. Staff served on the MES and facilitated workshops at the meeting. Staff discussed:

- How California is using the results of USC modeling work for maritime planning.
- Plans to create in-harbor hazard maps and guidance on how to use them during event.
- How modeling results were translated to maps for Tsunami Response Playbooks and dangerous current duration.
- Offshore safety zones evacuation considerations, including 'Safe offshore depth': 30 fathoms (180ft).

AGU Fall Meeting

Cal OES and CGS staffers are preparing to co-sponsor and attend the American Geophysical Union (AGU) meeting on December 15-19, 2014 in San Francisco. Staff coordinated with fellow NTHMP chairs, National Tsunami Warning Center (NTWC) Director, NOAA Alaska

Director, and CGS on scheduling panel presentations. Tsunami planners, modelers, and other professionals will present topics including:

- "Evaluation and Application of Probabilistic Tsunami Hazard Analysis in California"
- "The FASTER Approach: A New Tool for Calculating Real-Time Tsunami Flood Hazards"
- "Assessment of Near Shore Hazard due to Tsunami-Induced Currents"
- "The SAFRR Tsunami Scenario: from publication to implementation"

Submitted by: Mark R. Johnson, Branch Chief, and Kevin Miller, Tsunami Program Officer, California Governor's Office of Emergency Services Earthquake and Tsunami Program.

Colorado Earthquake Hazard Mitigation Council

The ad hoc Colorado Earthquake Hazard Mitigation Council (CEHMC) continues to meet bi-monthly on the campus of the Colorado School of Mines.

Seismic activity has continued west of Trinidad in the Raton Basin in southern Colorado. The Raton Basin is one of only a few sedimentary basins in the United States that has high geothermal heat flow. The Basin is located at the eastern edge of the Rio Grande Rift. There is a small volcanic anomaly just to the south of the seismic activity. Based on the premise that the majority of the recent earthquakes in this area are being induced or triggered by injection of disposal water from fracking operations, the 2014 National Seismic Hazard Maps do not include the earthquakes in the hazard database. They are then considered as non-tectonic events pending further evaluation of the methodology by which they could be included in the hazard calculation or how they might be considered deterministically.

The CEHMC provided a letter of support for further investigation of the Cheraw fault in Southern Colorado. Preliminary investigations by Fugro Consultants, Inc. (Mark Zellman) indicated the fault trace to be significantly longer than previously estimated. The USGS has since indicated that a NEHRP proposal for the Cheraw fault study was highly ranked and recommended for funding.

CEHMC Co-Chair Rob Jackson is a member of the Earthquake Engineering Research Institute (EERI). EERI has sponsored a School Seismic Safety Initiative. Working groups have developed a draft Strategic Action Plan that focuses on eliminating URM schools by 2033, decreasing the seismic vulnerability of new and existing schools, support for screenings and inventory, outreach and other activities to improve the seismic resiliency of schools. The plan is in progress and will be further developed in 2015.

The CEHMC policy recommendation on seismic design of public schools is consistent with the WSSPC Policy Recommendation for Seismic Design of New Schools. The recommendation has not yet been implemented by the State of Colorado.

The CEHMC participated in and supported the 2014 Great Colorado ShakeOut. Over 35000 participants were registered in Colorado this year. Last year Colorado was a part of the Great Rocky Mountain ShakeOut that also included Wyoming and Montana.

The CEHMC was represented at the Western States Seismic Policy Council's 2014 Annual Meeting in Anchorage and is participating in the WSSPC committees.

The Council is sad to report that geophysicist and longtime CEHMC Co-Chair John Nicholl, Jr. passed away on September 2, 2014.

Submitted by Rob Jackson, Co-Chair, Colorado Earthquake Hazard Mitigation Council.

Guam Homeland Security Office of Civil Defense

Goals and Objectives

The overall goal of Guam Homeland Security/Office of Civil Defense is to provide residents and visitors with a properly planned, organized, equipped, trained and exercised emergency management and response force. GHS/OCD is committed to ensuring the island's prepared for earthquake specific preparedness and response efforts of the island community. To achieve this goal, the Earthquake Program has established the following objectives:

Objective 1: Ensure earthquake preparedness is given a high priority within local government and the community.
Objective 2: Promote community earthquake awareness and self-sufficiency
Objective 3: Improve earthquake notification through public information

Accomplishments

Guam's Earthquake Awareness & Education Project:
Earthquake Preparedness is achieved through readiness measures that expedite emergency response and recovery. Awareness and Education is critical to preparedness actions Guam communities can take to response and recover from any disaster. Since 2010, Guam has participated in the Great Guam Shakeout with 38,000 residents pledging their support to become earthquake prepared. As of 2014, that number has increased to 82,000 residents, a sure sign Guam is excited to participate in Earthquake Awareness and Education.

GHS/OCD continues to schedule Earthquake Preparedness outreach at schools, government agencies and private agencies to become better prepared for an Earthquake and other disasters. Producing outreach materials such as Earthquake Ready Cards and Brochures have been beneficial in providing Awareness and Education for the Community. Earthquake Preparedness Media Campaign continue to benefit the community to become Earthquake Prepared.

Earthquake Training:
FEMA developed the National Earthquake Technical Assistance Program (NETAP) as a mechanism for delivering direct assistance to the public through State, local or tribal government entities, to increase their knowledge and ability to analyze their risk, make a plan, and take actions aimed at reducing earthquake risk and supporting overall community resilience.

NETAP Training approved and delivered for Guam's Earthquake Program

1. FEMA E-74: Reducing the Risks of Nonstructural Earthquake Damage.
2. FEMA P-749: Earthquake-Resistant Design Concepts: An Introduction to the NEHRP Recommended Seismic Provisions for New Buildings And Other Structures.
3. FEMA P-767: Earthquake Mitigation for Hospitals
4. FEMA P-909: Train-the-Trainer: Home and Business Earthquake Safety and Mitigation.

Hawaii State Report

Hawaii Emergency Management Agency and Hawaii Earthquake & Tsunami Advisory Committee

Hawaii Emergency Management Agency (HI-EMA), formerly Hawaii State Civil Defense (Note: State agency name change as of July 1st), collaborated during 2014 with several key working groups, including the Hawaii Earthquake & Tsunami Advisory Committee (HETAC) (formerly - Hawaii State Earthquake Advisory Committee), Hawaii State Hazard Mitigation Forum (HSMF) and the newly re-established Weather Impact Advisory Committee (WAIC) (formerly - Hawaii State Hurricane Advisory Committee).

These committees continued to work with partners in the private sector, government agencies, the National Tsunami Hazard Mitigation Program (NTHMP-NOAA), National Earthquake Hazards Reduction Program (NEHRP- FEMA), Post Disaster Mitigation (PDM-FEMA), Emergency Management Performance Grant (EMPG-FEMA), University of Hawaii, and the Pacific Disaster Center (PDC) in an ongoing commitment and focus on earthquake, tsunami, and extreme weather concerns, risks, and planning.

The committees/groups have helped guide research and secured funding for mitigation projects for the State of Hawaii. State and County Multi-Hazard Mitigation Plans include statewide risk and vulnerability assessments of seismic exposure, as well as proposed mitigation actions and capabilities in the State of Hawaii.

Earthquake

For over twenty years (est. September 1990) the Hawaii Earthquake & Tsunami Advisory Committee (HETAC) has served as an advisory body to Hawaii Emergency Management Agency. HETAC meets quarterly to promote activities to include, but not limited to, research, project development and management, and mitigation. In collaboration with the other committees and agencies mentioned above, the list below reflects the seismic efforts in Hawaii through HETAC contributions:

- Hawaii participated in and continues support of the Great Hawaii ShakeOut
- Hosted the Hawaii Emergency preparedness workshop – September 2014
- Building code upgrades:
  - Structural Engineers Association of Hawaii proposed upgrade of seismic zonation of City and County of Honolulu to Zone IIA)
  - Upgraded Hawaii County from Seismic Zone III to Seismic Zone IV
  - Moved to International Building Code
- Training:
  - Applied Technology Council (ATC-20) Post-Earthquake Safety Evaluation of Buildings since 1995 have trained over 100 engineers and architects to conduct surveys. After damaging earthquakes in October 2006, roughly 1700 inspections were conducted.

- Technical development:
  - Homeowner's Guide to Hurricane and Earthquake Retrofits, initially produced and distributed in hard copy, then converted to digital format.
  - Loss estimation modeling: Early investment in HAZUS modeling tool, Verification of HAZUS inventories, and HAZUS atlas of earthquake scenarios.

- **Recent quarterly meeting agenda items:**
  - FEMA P-749 training (earthquake-resistant design concepts)
  - Great Aleutian Tsunami (modeling/mapping/planning)
  - HETAC Five-year plan
  - International Building Code implementation and upgrade
  - Probabilistic seismic hazards map update for State of Hawaii
  - Project review and monitoring

Training

Hawaii Emergency Management Agency (HI-EMA) participated in training events with its personnel to ensure the utmost readiness to respond to all-hazard events. Staff training included:

- Emergency Management 101,
- HURREVAC,
- SPO 120 Small Purchase Method of Procurement training,
- Understanding the Emergency Management Assistance Compact,
- Social Media for Natural Disaster Response and Recovery provided by NDTPC,
- Siren Modernization,
- FEMA Preliminary Damage Assessment,
- FEMA Individual Assistance, Collecting and Reporting Financial Administration and Damage Information, HI-EMA arranged for the FEMA Public Assistance, Individual Assistance and Debris Management, and the Collecting and Reporting Financial Administration and Damage Information trainings to be conducted in the four Hawaii counties (Oahu, Hawaii, Kauai & Maui),
- FEMA Debris Management,
- Fire Extinguisher,
- FEMA Public Assistance, and EMMIE Grantee External and Internal Modules,
- FEMA P-749 Earthquake-Resistant Design Concepts on Maui & Hawaii Islands, and
- Wind Design Provisions of the Hawaii State Building Code on Oahu, Hawaii, Kauai & Maui. (Total 7 presentations)

HI-EMA has continued to require all personnel complete:

- Incident Command Systems (ICS)
- National Incident Management Systems (NIMS)

Independent Study Program (ISP) training:

- IS-100, IS-200, IS-700, IS- 800, IS-701, IS-702, IS-703, IS-704,

Professional Development Series:

- IS-120, IS 230, IS-235, IS-240, IS- 241, IS-242, IS-244, IS-701, IS 702, IS-703, and IS-704.

Other IS classes completed:

- IS-31.a Mitigation for the Grant Applicant
- IS-803 Emergency Support Function (ESF) #3 Public Works and Engineering
  Staff members attended ICS-300 Intermediate ICS for Expanding Incidents and ICS-400 Advanced ICS courses during this reporting period.

Projects and Activities

- Mapping & Modeling, current focus development of the public evacuation information campaign in response to a M9.2 event generating a large tsunami in the Aleutian Islands and the impact on the Hawaiian Islands, harbor and bays; prototyping of tsunami data products such as offshore safety zones and in-harbor hazard maps of current speed, surge elevation, and drawdown.
- Tsunami Observer Program
  - Continuous Training/Recruiting/Maintenance
- New and up-dated outreach material
  - Ocean Safety Card
  - Visitors Guide
  - Boater Guide
  - Are You Ready Brochure?
- SCD Web update
- EEFI Radio (Foreign Language Radio)
  - Four Stations (on all Islands)
  - 16 Languages
  - Public Service Announcements (PSAs)
  - Emergency Directions
- Kauai Tsunami Signage
- Theaters PSAs
- Baseline Tsunami Awareness Survey
- Staff Go Book
- April is Tsunami Awareness Month in Hawaii due to the historical significance of the April 1, 1946 tsunami. This year HI-EMA is working with the International Tsunami Information Center, Pacific Services Center, Pacific Tsunami Museum, and others to increase awareness.
  - 50th Anniversary of the Establishment of the PTWS in 1965. The U.S. is hosting the 26th UNESCO Intergovernmental Oceanographic Commission/ International Coordination Group/ Pacific Tsunami Warning and Mitigation System (ICG/PTWS), from April 22-24, 2015 in Honolulu.
  - The ICG/PTWS Meeting will be preceded by an International Tsunami Symposium to be held at the new NOAA Inouye Regional Center on Ford Island, Honolulu. April 20-21, 2015.
  - Hawaii will host a commemorative 2015 Tsunami Awareness Month to showcase what Hawaii has done over the past 50 years.
  - Kickoff at the 2015 PRiMO Conference (March 24-26).
  - Month of planned activities in all Hawaii Counties.
  - Involve all economic sectors (tourism, health, education, government/military, transportation, agriculture, marine, etc.) reflecting on the progress made in preparing Hawaii for tsunamis.

- Review and share Hawaii's known vulnerabilities, current plans, and its resilience as showcase for the ICG/PTWS & International Tsunami Symposium.
- Hilo/Pacific Tsunami Museum Activities
- Governor & Mayor Proclamations
- Pacific Tsunami Museum is working on creating new exhibits focused on response awareness and Science. The Science Room will be revamped with current technology and include interactive displays, updated run-up maps, and the latest from the newly located Pacific Tsunami Warning Center, including Development/ Design/ Research/ Supplies/ Computer Equipment/ Installation/ Software

- HHARP/TsunamiReady/StormReady
  - Develop new communities
  - Support active communities
  - Recognized communities – currently engaging: Kaneohe, Kapolei, USCG, North Shore, Waianae, Manoa Valley, Nanakuli, Kaaawa, Waimalalo, Kailua, Ewa Beach, Hawaii Kai

Exercises

This year's Emergency Management Agency's exercise, entitled *Kai Mimiki* (literally translated from Hawaiian to mean a large wave from the sea), was conducted and included a Distant Tsunami exercise and a Local Tsunami exercise. Both exercises are coordinated with the monthly testing of the warning sirens. The participants included: Pacific Tsunami Warning Center (PTWC); Hawaii County Civil Defense Agency; Maui County Civil Defense Agency; Kauai County Civil Defense Agency; Honolulu City and County Department of Emergency Management; the State and County Warning Points, and the National Weather Service (NWS). The April exercise focused on how various federal, state, and county agencies would response and warn the public of a large earthquake off the Big Island. In October the exercise focused on a distant earthquake from Alaska which would produce a tsunami that will impact the Hawaiian Islands.

Exercise *Makani Pahili* 2014 (MP14) was designed to provide an opportunity to exercise collectively with a common hurricane scenario, enhance disaster preparedness for government and private sector agencies statewide, and provide a forum to enable agencies to identify areas for improvement. Exercise participants responded to hurricane Watch and Warning messages as well as guidance received from HI-EMA. Participating organizations and their planners used the Emergency Management Agency ExPlan of published damage scenarios to allow their own participants to get the most benefit from the exercise.

In addition to these efforts HI-EMA has hosted two statewide workshops:

- Hawaii Emergency Preparedness Workshop
- Training and Education Planning and Development Workshop

Submitted by: Kevin Richards, Earthquake and Tsunami Program Planner, Hawaii Emergency Management Agency.

Idaho State Report

2014 Idaho Earthquakes

There were at least 388 earthquakes with magnitudes >1 in Idaho between 11/1/13 and 10/17/14. The year was notable for three earthquake swarms near Challis, McCall, and Driggs. The Challis swarm began in late March about 20-30 km northwest of the Lost River Fault that produced the M6.9 1983 Borah Peak earthquake. For about a month, more than 100 events outlined a linear trend similar to the strike of the Lost River fault. On April 13, a magnitude 4.9 earthquake occurred in the swarm area. This was the largest earthquake in Idaho for 20 years. Damage to a masonry chimney near the epicenter was reported. The Challis swarm generated considerable interest from both the public and the seismological community. The USGS and the University of Utah Seismograph Stations (UUSS) cooperated to install and operate a temporary five station seismic array to monitor the swarm from mid-April to September. The temporary array significantly improved earthquake locations. Funding is being sought for a permanent Challis station; meanwhile, a single station will be operated by UUSS until mid-2015. Many of the earthquakes detected by the temporary array were located and reported to the USGS by the Montana Bureau of Mines and Geology (MBMG). First-motion focal mechanisms computed by the MBMG of larger events in the swarm show oblique normal and strike-slip faulting consistent with those observed for the 1983 Borah Peak earthquake.

The McCall and Driggs swarms each began in December, 2013. The McCall swarm consisted of 12 earthquakes between M1-2, and 7 earthquakes between M2-3. The largest McCall event was M3.0 on 12/12. The Driggs swarm occurred almost directly beneath the city of Driggs and was widely felt by residents. It formed an east-west cluster of shallow earthquakes ranging in magnitude from 3.1 to <1. On 12/29 and 12/30, over 100 events per day were recorded. Most of the events were located and reported by the MBMG. Fault plane solutions using P-wave first motions show slip on an N-S trending normal fault.

Monitoring of Mining-Induced Seismicity

In conjunction with on-going research on the Ground Control Safety for Deep Vein Mines Project, the National Institute for Occupational Safety and Health (NIOSH) Spokane Mining Research Division has partnered with the Hecla Mining Company to develop a surface seismic monitoring network to study mining-induced seismicity near the Lucky Friday Mine, Coeur d'Alene Mining District, northern Idaho. This seismic network will consist of seven monitoring stations and a data repeater station which will continuously monitor seismicity in the area. The data from this seismic network will be sent via Internet to the NIOSH Spokane Mining Research Division office for recording, analysis, and archiving. The data from this seismic network will be used in combination with Hecla's in-mine seismic monitoring system at the Lucky Friday Mine to determine the location, magnitude, and source parameters for seismic events and thus provide a better understanding of mining-related seismicity. The outputs disseminated by this project will improve safety in deep vein mines by providing a better understanding of ground control hazards such as roof falls and failures of ground support, and this novel information will also advance the field of geotechnical engineering for underground structures subjected to dynamic forces. The Lucky Friday surface seismic monitoring system is currently being implemented. Three interim

seismic monitoring stations were established in late 2013 near the Lucky Friday Mine as well as an Earthworm seismic data acquisition and processing system at the mine.

NIOSH Spokane Mining Research Division's longer-term research plans include additional seismic stations throughout the Coeur d'Alene Mining District to further study mining-induced, local, and regional seismicity. Two seismic monitoring stations were installed underground in partnership with US Silver & Gold at the Galena Mine in early 2014. NIOSH Spokane Mining Research Division also partners with Revett Mining to monitor and study mining-related seismicity at the Troy Mine in northwestern Montana.

Hazard Mitigation Activities

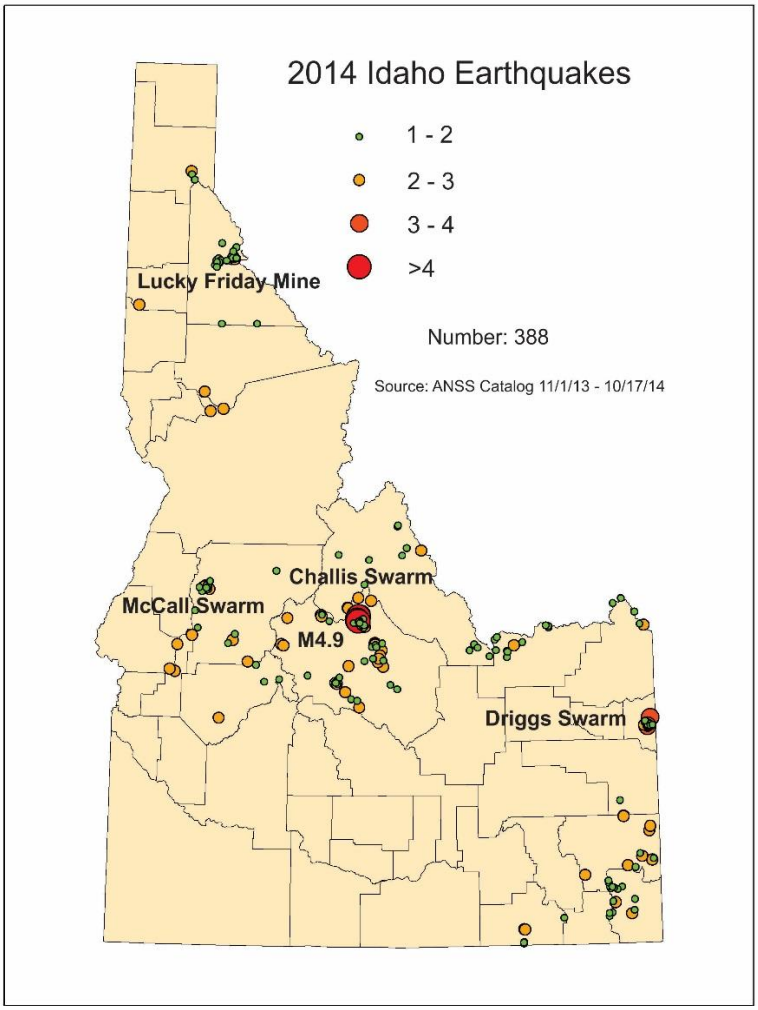
NEHRP seismic site class and liquefaction susceptibility maps were completed for the Long Valley area of Valley County by the Idaho Geological Survey and Boise State University (BSU), with funding from the Idaho Bureau of Homeland Security (IBHS). Mapping focused on the communities of McCall, Donnelley, and Cascade. Seismic data were collected using an innovative "land streamer" geophone string pulled behind a vehicle. The land streamer was designed and operated by Lee Liberty of BSU. Liquefaction susceptibility was evaluated in part by comparing p-wave and shear wave velocity measurements to refraction-derived water table depth estimates. Water well logs and surficial geologic maps were also used in the liquefaction susceptibility analysis. Results of the study were presented to the Valley County local emergency planning committee and will also be posted on the IGS website at *www.idahogeology.org*.

IBHS applied for three FY2015 NEHRP State Support projects as a means of supporting several State Hazard Mitigation Plan goals and objectives. In order of priorities, a seismic site classification and liquefaction susceptibility mapping project was requested for Payette County in the vicinity of Emmett. The second priority project was a rapid visual assessment (RVS, FEMA 154) of Idaho county emergency operations centers and other critical infrastructures. To complement the goals and objectives of this seismic mitigation action, there is ongoing discussion with the Idaho Division of Building Safety to develop funding for statewide RVS of all school facilities. The third priority project is the acquisition, hardening and permanent maintenance of a permanent Challis seismic monitoring station.

The seismic technical advisory group met in anticipation of the annual Idaho State Hazard Mitigation Plan (SHMP) maintenance meeting. Discussion included increasing LiDAR acquisition and paleoseismic studies of seven Quaternary faults in Idaho. IGS discussed the temporary Challis seismic monitoring network and the need for more monitoring capability. The recently published RiskMAP portfolio includes seismic as one of the three major hazards included in that document. The Idaho Department of Water Resources made a presentation on geothermal wells and induced seismicity from fracking at the U.S. Geothermal facility at Raft River, concluding that there is not a major risk. These topics will be presented to the SHMP revision executive meeting in November for consideration as additional mitigation activities.

Progress on Implemented WSSPC Member-Approved Policies

IBHS fully supports the WSSPC member-approved policies. Further work is anticipated by IBHS staff and the Seismic Technical Advisory group to establish the mechanisms needed for full implementation of those policies.



Submitted by: William Phillips, Idaho Geological Survey; William R. Hammond, CDC/NIOSH Spokane Mining Research Division; and Mark Stephensen, Idaho Bureau of Homeland Security. Information on the Challis and Driggs earthquake swarms was provided by Mike Stickney, Montana Bureau of Mines and Geology.

Montana Bureau of Mines and Geology and Montana Disaster and Emergency Services

The northern Intermountain Seismic Belt remained seismically active between October 1, 2013 and September 30, 2014. During this period, the Earthquake Studies Office at the Montana Bureau of Mines and Geology (MBMG) used data from the Montana Regional Seismograph Network to determine hypocenter locations and magnitudes for 2,124 earthquakes within Montana and in adjacent parts of Idaho, Wyoming, and Canada. This total included 72 earthquakes with magnitudes from 3.0 to 4.8. Residents reported feeling 43 earthquakes, but no events caused damage. Information about recent Montana earthquakes is available on the Earthquake Studies Office website *http://mbmgquake.mtech.edu*.

Thirteen earthquakes with magnitudes from 3.0 to 3.9 occurred in Montana. The largest earthquake (magnitude 3.9) during the past year occurred on July 28, 2014 centered just north of Dillon. Forty-five residents reported feeling this earthquake that had a maximum intensity of III on the Modified Mercalli Intensity scale as reported on the US Geological Survey's *Did You Feel It* website (*http://earthquake.usgs. gov/earthquakes/dyfi/*).This earthquake occurred near the location of the magnitude 5.6 Dillon earthquake on July 26, 2005.

A magnitude 3.8 earthquake occurred near the town of Froid in northeastern Montana on February 25, 2013 and was felt with a maximum intensity of V. Although the event occurred near the western edge of the Bakken oil field, there is no evidence to suggest that it was anything other than a natural earthquake occurring near the northeast-trending Brockton-Froid fault zone. Large earthquakes occurred in northeastern Montana in 1909 (magnitude 5.4) and 1943 (magnitude 4.3).

An area approximately 10 km southeast of Lincoln produced magnitude 3.5 (April 23, 2013) and magnitude 3.6 (September 28, 2014) earthquakes as well as 26 other low-magnitude events during the reporting period. Both large events were locally felt. The occurrence of more than 230 earthquakes including a magnitude 3.9 tremor on April 1, 1993 since 1982 demonstrates persistent activity in this area.

An area 12 km southeast of Townsend experienced a magnitude 3.6 earthquake on July 23, 2014 and a magnitude 3.0 on July 26, 2014. The July 23 earthquake was reported felt with a maximum intensity of IV by 14 area residents.

The Thompson Lakes area in northwestern Montana, 45 km southeast of Libby, experienced a magnitude 3.4 earthquake on May 13, 2014 that was followed, during the next two days, by 11 aftershocks with magnitudes from 1.0 to 2.4. The main shock was felt in Libby and Troy with a maximum intensity of II. Seven other earthquakes with magnitudes ranging from 1.0 to 2.2 occurred in this same area during the reporting period.

Twenty-two seismic events with magnitudes ranging from 1.2 to 2.5 occurred throughout the year in the Coeur d'Alene Mining District in north Idaho. These events were most likely related to deep hard-rock mining.

Continuing into its ninth year, the aftershock sequence of the July 26, 2005 Dillon earthquake (magnitude 5.6) included 43 aftershocks with magnitudes of 1.0 or larger. The number of magnitude ≥ 1.0 aftershocks located since the Dillon main shock is now 1,799.

The MBMG Earthquake Studies Office continues to receive funding from the U.S. Geological Survey's Advanced National Seismic System for partial support of the Montana Regional Seismograph Network. These funds are used to procure technical assistance with repair and maintenance of seismographs and telemetry equipment, data archival, and general network operations. Together with generous support from the Confederated Salish and Kootenai Tribes, Advanced National Seismic System support allows the MBMG to fund a full-time assistant/seismic analyst in the Earthquake Studies Office.

The MBMG has completed a cooperative agreement with FEMA's Earthquake Hazards Reduction State Assistance Program. The award enabled the MBMG to make Montana's 1982-2014 earthquake catalog available as a data layer on MBMG's Online Mapping Application, to provide visual, easy, and versatile access to Montana's extensive historical earthquake record. Improved access to these data—including current seismicity—enhances Montana's earthquake/seismic hazard education and outreach efforts. The Montana Earthquake Mapper is available at: *http://data.mbmg.mtech.edu/mapper/*.

As described in USGS Circular 1351, the MBMG is a Collaborating Organization in the Yellowstone Volcano Observatory. The MBMG will coordinate with the seismic monitoring team in the event of geologic unrest in Yellowstone.

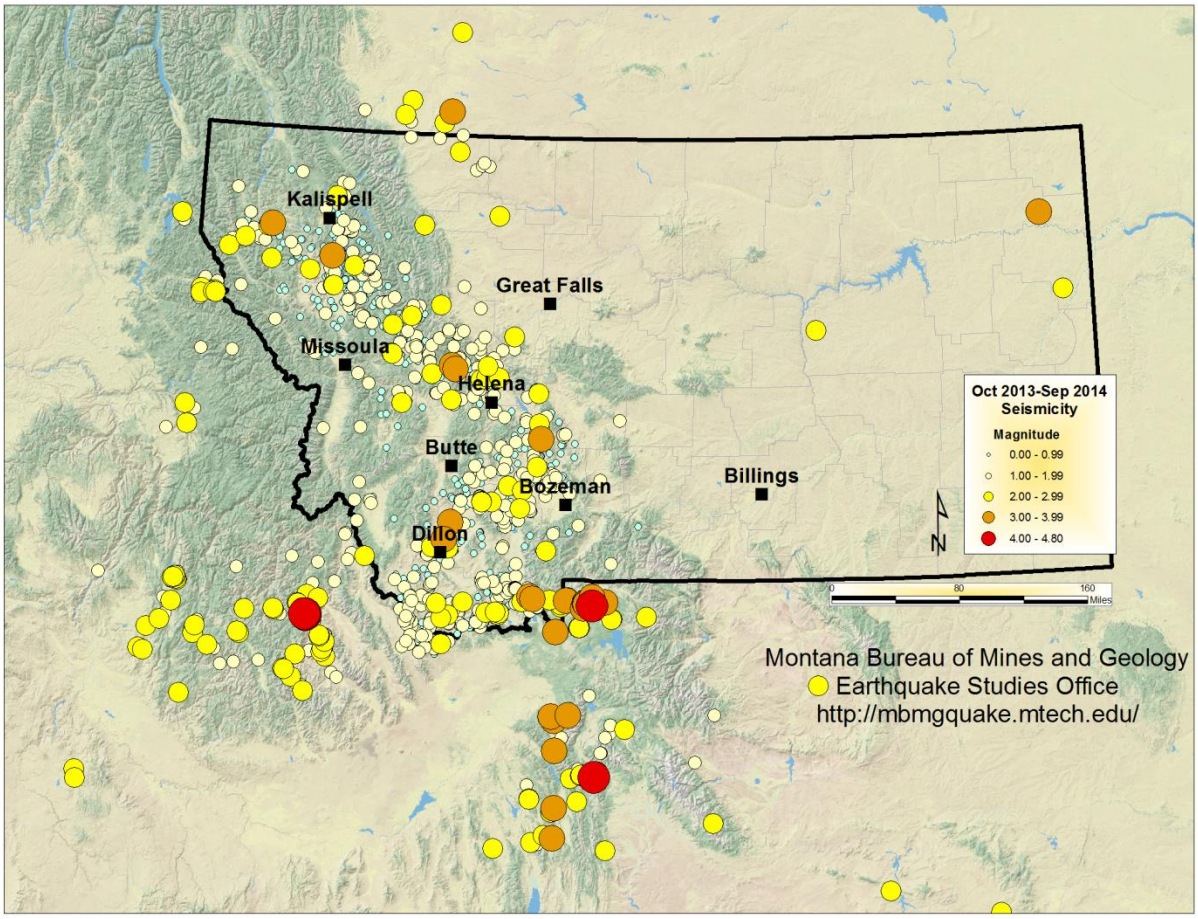
Montana participated in its second 'ShakeOut' on October 22, 2014 (our first as a stand-alone state). Over 156,000 Montana residents participated in Montana's second ShakeOut event coordinated by Betsy Miller of the Governor's Office of Community Service.

Current Seismic Retrofits in progress:

Creative Arts Complex MSU Bozeman, MT; 2/3rds complete ($3 million total cost, FEMA Pre-Disaster Mitigation grant funding $2.2 million Federal Share). This project has been successfully completed and the State of Montana is closing it out with FEMA.

Mathews Hall UM-Western, Dillon, MT; In Phase I Engineering-Environmental Historic Preservation Award ($1.14 million total cost, FEMA Hazard Mitigation Grant Program funding $858,000 Federal Share). This project is still in pre-award. The State Architecture and Engineering Division is negotiating with Montana Disaster and Emergency Services (Grantee) to keep costs within the FEMA approved Benefit Cost Analysis in order to save the project from cancellation.

Montana Law Enforcement Academy Non-Structural Retrofit HMGP award ($125,600 total cost, FEMA Federal Share funding $94,200) awarded and underway.



Map of 2,164 earthquake epicenters from October 1, 2013 through September 30, 2014 determined from Montana Regional Seismograph Network data.

Submitted by Mike Stickney, Director, Earthquake Studies Office and Senior Research Geologist, Montana Bureau of Mines and Geology with a contribution from Kent Atwood, Mitigation Officer, Montana Department of Military Affairs, Disaster and Emergency Services.

Nevada Earthquake Safety Council, Nevada Bureau of Mines and Geology, Nevada Seismological Laboratory, and Nevada Division of Emergency Management

Nevada Division of Emergency Management and Nevada Earthquake Safety Council

Nevada continues to rank as the third State in the nation for being at most risk for large magnitude earthquakes. In realizing the potential effect of the devastation and loss of life that a major earthquake can cause, Clark County School District submitted a Pre-Disaster Mitigation grant application which was awarded to install automatic gas shut-off valves in their schools and facilities. In addition to mitigating damage and loss, once all of Clark County School District's schools and facilities are fitted with automatic gas shut-off valves, they will receive reductions in their annual insurance premiums.

Additionally, on August 13, 2014, the Nevada Earthquake Safety Council (NESC) and the California Seismic Safety Commission (CSSC) participated in a joint workshop held at the Granlibakken Conference Center in Tahoe City, CA, where approximately 50 people from California, Nevada and FEMA participated. Members of NESC gave a historical overview of earthquakes in Nevada and California, the possibility of lake tsunamis as a result of earthquakes, and the history of NESC and CSSC. CSSC's collaborative partners explained the Global Earthquake Model, imaging of data through space, detection of human heartbeats in rubble, small business development centers and how they are helping small businesses prepare for earthquakes. Throughout this one day workshop, members of both NESC and CSSC discussed how they can work in partnership on future projects.

Finally, this year Clark County partnered with the Earthquake Engineering Research Institute (EERI) through the National Earthquake Hazards Reduction Program (NEHRP) to carry out a ground-truthing project in Clark County verifying the unreinforced masonry (URM) buildings throughout Clark County against a tentative list of URM buildings. This project is still ongoing at this point.

Earthquake Preparedness Activities by the Nevada Bureau of Mines and Geology

The Nevada Bureau of Mines and Geology (NBMG) compiled a new earthquake catalog for use in Nevada's MyPlan Web Application, which portrays natural hazards in a map format. This earthquake catalog added over 1000 earthquakes that were not in the existing Nevada digital catalog. Most of these new events were foreshocks and aftershocks that had been left out because they lacked locations or events that have been found more recently by historical earthquake research.

In conjunction with the Nevada Seismological Laboratory, NBMG developed a new memo format for reporting the HAZUS consequence results of a significant earthquake to the Nevada Division of Emergency Management. The updated procedure includes basing HAZUS

estimations on a ShakeMap ground motion format that is provided by the Seismological Laboratory.

NBMG developed the earthquake hazard mitigation section of the Douglas County Hazard Mitigation Plan. This section included a discussion of the historical earthquakes that have affected Douglas County, the major earthquake faults in the county, and potential mitigation activities, including a prioritization table of actions.

NBMG continues intensifying efforts to get Nevadans ready for earthquakes on a personal level through talks and the ShakeOut event. The earthquake hazard has been unusually low in the last few decades and the belief of the earthquake threat by Nevadans needs to be significantly increased.

NBMG has participated in the Nevada Earthquake Safety Council, the Nevada Hazard Mitigation and Planning Committee, and functions of Nevada cities and counties.

Nevada Seismological Laboratory

The state of Nevada has had a very active 2014 with over 10,000 earthquakes located thus far, including a handful of M4 earthquakes. In late January, several M4 temblors shook the southeast corner of the state near Caliente. Presently, a vigorous swarm in the northwest region of the state near Denio is responsible for over 30 M3s, including two M4s in late October, early November. This swarm remains unabated. Locating these events has been a struggle due to the lack of seismometers in this remote region of the state. Las Vegas recently had a notable earthquake, a M3.6 late-night event that was located 20 miles south of the strip. This earthquake was the largest of its kind in the Las Vegas area in several decades. Otherwise, the Walker Lane that sits astride the Nevada–California border has had many notable M3+ earthquakes and swarms, including two closely spaced swarms near Mammoth that started in late September, a swarm of M3s near Virginia City in January, and a pair of M3 earthquakes in January between Battle Mountain and Carlin.

On an infrastructure front, the Nevada Seismological Laboratory continues to upgrade their microwave network to support high quality, digital links to most parts of the state. Of note, a broadband station was installed east of Ely, Nevada in the early summer. An upgrade of communication links and seismometers continues in the Tahoe-Reno region. Some upgrades in and around Death Valley National Park will likely begin this fall/winter. Networks associated with monitoring of mines near Carlin (Barrick and Newmont) and supporting the Source Physics Experiment on the Nevada Test Site has enabled a greater reach in terms of seismic monitoring. Lastly, the lab has begun to support multihazard sensors on their network, including HD fire cameras. This system has had early successes in the Tahoe region this summer in helping fire personnel knock down smaller fires before they become bigger ones. These cameras also tracked progress of the King Fire that nearly burned into the Tahoe basin in late September. California state officials have begun to take note of this dual use platform as they decide how to support earthquake early warning.

The Great Nevada ShakeOut was a success with 571,000+ Nevadans participating in this international drill. The number of participants grew for the 5th straight year! The lab was also able to bring the earthquake simulation truck (aka Big Shaker) to schools in both Reno, Incline and Las Vegas. The Las Vegas demo was just after the Napa M6.0 earthquake — so interest was keen.

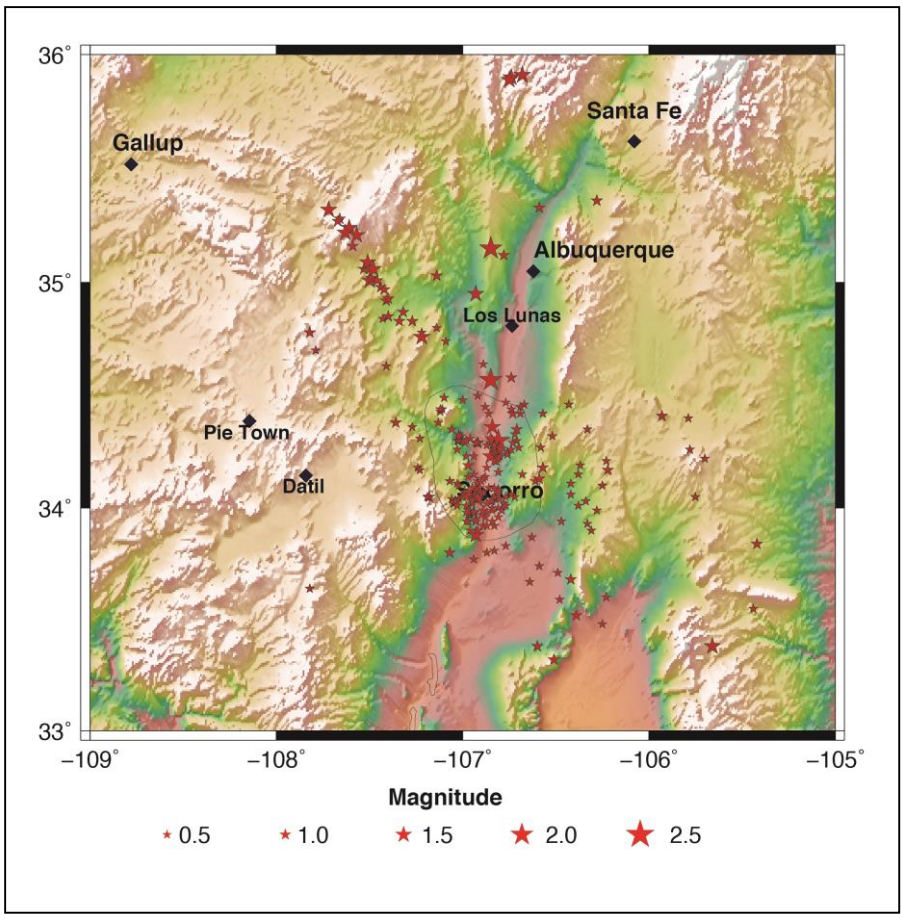
New Mexico Institute of Mining and Technology, New Mexico Bureau of Geology and Mineral Resources, New Mexico Department of Homeland Security, and Emergency Management

Seismicity in Central New Mexico during October 1, 2013 – September 30, 2014

The New Mexico Tech Seismological Observatory (NMTSO) located **268** earthquakes from October 1, 2013 – September 30, 2014. A majority of these events were located in the central Rio Grande rift (near Socorro, Figure 1). These events do not include small clustering of events that have been observed, but not located, near Raton in northeast NM, near Carlsbad in southeast NM, and a group of events northwest of Las Cruces (near Silver City). These clusters may be induced by oil-field activities and/or explosions from nearby mines. The largest located event recorded by the NMTSO during this time was an Md magnitude 2.2 earthquake that occurred on June 13, 2014, located southwest of Socorro. Failure of antiquated timing system in January 2014 closed NMTSO networks until May, 2014, when new data center equipment was enabled. The forced removal of radio repeater equipment in February 2014 from Socorro Mountain, due to statewide communications changes, resulted in half of the Socorro network stations not being able to communicate with the NMTSO, explaining the paucity of earthquakes recorded and located.

The figure on the following page shows earthquakes in New Mexico and bordering regions during October 1, 2013 – September 30, 2014 (Ingate, unpublished data from the New Mexico Tech Seismological Observatory).

We have modified publicly available webpages that contain information about earthquakes recorded and located by the NMT Seismological Observatory, found here: *www.ees.nmt.edu/outside/NMTSO/quakelist.html*. Because of the limited funding for the seismic networks, however, we cannot certify that these webpages are updated in a timely fashion, as the effort for locating events in this area largely falls to NMT graduate students when available. The network around the Waste Isolation Pilot Plant (WIPP) is funded through Nuclear Waste Partnerships, LLC, but those locations are not authorized for release. The Socorro Magma Body network is completely unfunded, thus locations for this area and the rest of the state are more limited.



Policy Recommendation 14-3: Earthquake Monitoring Networks

- NMTSO submitted a proposal to DoE to update the analog WIPP seismic network to a modern digital borehole network. The rejection of this proposal by DoE will negatively impact abilities to locate earthquakes within the state.

- DHSEM submitted a proposal to upgrade ten short-period vertical component seismic stations within the Socorro Magma Body Seismic Network (SMBSN) through NEHRP. Although it is understood that NEHRP won't fund monitoring networks, we were encouraged by FEMA Headquarters to submit the request in writing. We anticipate they will forward the request to USGS for potential funding.

Notable publications related to earthquakes and faults in New Mexico

- Edel, S., Bilek, S.L., and Ingate, S., Examining induced seismicity in SE New Mexico in the vicinity of the Waste Isolation Pilot Plant, IRIS Workshop, June 2014.
- Edel, S., Bilek, S.L., and Ingate, S., Examining induced seismicity in SE New Mexico in the vicinity of the Waste Isolation Pilot Plant, SSA Annual Meeting, April 2014.
- Edel, S., Bilek, S.L., and Ingate, S., Examining induced seismicity in SE New Mexico in the vicinity of the Waste Isolation Pilot Plant, NMGS Spring meeting, April 2014.
- Nakai, J., A. Sheehan, and S.L. Bilek, Earthquakes of the Rio Grande Rift using Transportable Array and CREST data, AGU Annual Meeting, 2013.

- Morton, E.A. and Bilek, S.L., Limited Dynamic Earthquake Triggering in the Socorro Magma Body Region, Rio Grande Rift, New Mexico Bulletin of the Seismological Society of America, doi:10.1785/0120140021, 2014.

Paleoseismic work in New Mexico

We are not aware of any trench-related paleoseismic studies during October 1, 2013 – September 30, 2014, but there has been other work of relevance to Quaternary paleoseismicity. One is publication constraining the last rupture event of the Alamogordo fault to between 11.2 and 10.5 ka (radiocarbon years), at a location 12.5 km north-northeast of downtown Alamogordo (Koning, 2014; Rawling et al., 2014). Also, geologic mapping related to the STATEMAP has resulted in more accurate locations of Quaternary faults in several places in New Mexico. These mapped faults include the Sand Hill fault west of Albuquerque (Koning and Jochems, 2014), the Santa Fe fault southwest of Albuquerque (Ricketts and Karlstrom, 2014), and the Willow Draw-Dark Canyon fault system northwest of Truth or Consequences (Koning et al., 2014). Rinehart et al. (2014) mapped several Quaternary faults on the Black Butte quadrangle and were able to narrow the estimated ages of scarp formation. Two major fault zones trend northeastward near Black Butte, the Military Road fault zone (down to the east) and the Maes-Abo fault zone (down to the west).

Notable publications related to paleoseismicity and maps of Quaternary faults in New Mexico

- Koning, D.J., 2014, Exposure of the Alamogordo fault at Laborcita Canyon and radiocarbon age constraints for its last rupture event [minipaper]: New Mexico Geological Society, 65th Field Conference, Geology of the Sacramento Mountains Region,p. 92-94.
- Koning, D.J., and Jochems, A.P., 2014, Preliminary geologic map of the Benavidez Ranch quadrangle, Bernalillo and Sandoval Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open-file Digital Geologic Map OF-GM 234, scale 1:24,000.
- Koning, D.J., Jochems, A., Kelley, S.A., McLemore, V.T., and Cikoski, C.T., 2014, Preliminary geologic map of the Monticello quadrangle, Sierra and Socorro Counties, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open-file Digital Geologic Map OF-GM 245, scale 1:24,000.
- Rawling, G., Mack, G., Koning, D., Land, L., and McLemore, V., 2014, Stop 5, Alamogordo fault, second-day road log: Alamogordo to La Luz, Cloudcroft, and Bluff Spring: New Mexico Geological Society, 65th Field Conference, Geology of the Sacramento Mountains Region, p. 84-86.
- Ricketts, J.W., and Karlstrom, K.E., 2014, Geologic map of the South Garcia SE 7.5-minute quadrangle, Valencia County, New Mexico: New Mexico Bureau of Geology and Mineral Resources, Open-file Digital Geologic Map OF-GM 246, scale 1:24,000.
- Rinehart, A.J., Love, D.W., and Miller, P.L. 2014, Geologic map of the Black Butte quadrangle, Socorro and Valencia Counties: New Mexico Bureau of Geology and Mineral Resources Open-file Geologic Map 235, scale 1:24,000.

ShakeOut New Mexico

The first ever New Mexico ShakeOut! had 106,813 participants. 102,333 were from public schools (majority in Bernalillo County with one school in Valencia County). 1,892 participants were from

the health care industry (17 counties!). There were also 400 federal workers and 477 business participants. DHSEM hosted the drill in the State Emergency Operations Center and had 15 people participate. In support of multi-hazard risk reduction 90 floodplain managers participated in the drill at the New Mexico Floodplain Managers Association Fall Workshop. Data show every organization and agency grouped by type. DHSEM has submitted a request to have NEHRP funding cover the cost for Public Service Announcements, printing of posters and travel to provide outreach about the 2015 New Mexico ShakeOut.

Submitted By: Shane Ingate, Sue Bilek, Stanislav Edel, Dave Love, Dan Koning, New Mexico Bureau of Geology and Mineral Resources and Wendy Blackwell, New Mexico Department of Homeland Security and Emergency Management.

Oregon Emergency Management (OEM), Oregon Department of Geology and Mineral Industries (DOGAMI), and Oregon Seismic Safety Policy Advisory Commission (OSSPAC)

OSSPAC assisted with the recommendations issued by the Oregon Resilience Task Force (ORTF), which was staffed by OEM, and presented on September 30, 2014 to the Legislature. Numerous presentations to stakeholder groups, newspaper articles, radio and TV interviews, and earthquake and tsunami drills were conducted by OEM, DOGAMI and OSSPAC personnel throughout the year.

Oregon Military Department, Office of Emergency Management (OEM)
http://www.oregon.gov/OMD/OEM/Pages/index.aspx

WSSPC Policy Recommendation 12-2 Developing Earthquake Risk Reduction Strategies

Oregon Coast Visitor Tsunami Awareness Project
The purpose of the Oregon Coast Visitor Tsunami Awareness project is to improve the visitor's awareness of the tsunami hazards and to support the hospitality industry on the Oregon coast in becoming more prepared for tsunami events. It is being funded by the National Tsunami Hazard Mitigation Program (NTHMP), a part of the National Oceanographic and Atmospheric Administration (NOAA).

As part of this project, several products were created and made available, free of charge to hospitality groups. These products are:

- A short video that can be played on in-room television channels
- Publications that can be added to guest room guide/ notebooks
- Single source of templates for facility use and Best Management Practices (BMP) industry resources (Web accessible)

The materials can be found at
http://www.oregon.gov/OMD/OEM/Pages/plans_train/tsunamis.aspx

The outcome of this project will be improved preparedness by businesses serving the visitors to the Oregon coast and an improvement of tsunami awareness by our guests.
Visitors to the Oregon coast come from around the world and most will not know that earthquakes and tsunamis are hazards here. It is our responsibility to make sure that they are safe while they are our guests.

We hope that the video will be shown widely on the in-room channels, and on hotel lobby screens. The publications can be tailored to business branding and easily added to the guest room information notebooks.

Up and Out Tsunami Wayfinding Guidance Document
Working with the University of Portland and others, OEM brought together local residents and stakeholders in a World Café and Charrette gathering to identify the best way to mark the routes to high ground. This included new visual language for the signs, colors, types of signs, lighting, and the list goes on. It is important that this be a community-centered process in order to make sure that any new methods of wayfinding fit within the visual aesthetics of each community. The end product is a report that can help coastal communities develop effective evacuation strategies by giving them a range of ideas generated by the community meetings. This project will continue this year with students producing master plans of creative new wayfinding systems for two Oregon coast communities.

The first report can be found at
http://www.oregon.gov/OMD/OEM/Pages/plans_train/tsunamis.aspx.

Earthquake and Tsunami Preparedness for Vulnerable Populations Workshop
The Oregon Office of Emergency Management in association with Oregon Office on Disability and Health held a series of free workshops on Earthquake and Tsunami Preparedness for Vulnerable Populations. These workshops were intended for those who work with elders, daycare/infant care, people with disabilities, or other vulnerable groups to learn more about how to prepare for earthquakes and tsunamis, and other natural disasters.
Locations of workshops:

Tuesday, March 11, 2014	Brookings
Wednesday, March 12, 2014	Gold Beach
Thursday, March 13, 2014	Bandon
Friday, March 14, 2014	North Bend
Monday, March 17, 2014	Reedsport
Tuesday, March 18, 2014	Florence
Wednesday, March 19, 2014	Newport
Thursday, March 20, 2014	Lincoln City
Friday, March 21, 2014	Tillamook
Wednesday, March 26, 2014	Seaside
Thursday, March 27, 2014	Astoria

Workshop presenters:
Dr. Althea Rizzo, Geological Hazards Program Coordinator at the Oregon Office of Emergency Management. She is an experienced presenter with a long history of natural hazards education in Oregon.

Justin E. Ross, Disaster Preparedness Community Outreach and Training Program Coordinator for Oregon Office on Disability and Health. He is an emergency management professional specializing in vulnerable populations disaster planning and preparedness.

***Without Warning* Comic Book**
Working with one of the premier comic book houses, Dark Horse Comics, OEM developed a comic book about a teenager who must survive an earthquake, rescue her sister and get them both back home. This 12-page full color comic reaches an audience that is frequently ignored in

traditional outreach publications. The comic has been well-received and is already on its second printing. It is also available for mobile devices. It was funded by the Cascadia Region Earthquake Workgroup. Without Warning [link: *http://www.darkhorse.com/Blog/1823/without-warning-earthquake-safety-and-information*]

Cascadia Island Mapping

This first phase of the project will integrate tsunami and coastal earthquake hazard information into RAPTOR– "Island" mapping of coastal counties using landslide, liquefaction, ODOT, and other data sets, develop maps of the coastal counties that show where damage to infrastructure will create "islands" of isolated populations.

Working with local stakeholders, emergency management and first responders the mapping project will identify helicopter sites, critical infrastructure, and other information useful to response and recovery. The data collected will be converted into shapefiles/tables for import into RAPTOR for use in training, planning, and response efforts. The files will also be available to local counties and communities.

RAPTOR – Real Time Assessment and Planning Tool for Oregon – and its mobile for iPad version, iRAPTOR, enables authorized users within Oregon's emergency management community, and in bordering states and across the nation, to view and interact with critical geospatial basemaps, aerial imagery, preparedness, hazards, weather and event related data via the Internet - anywhere, anytime on a 24x7 basis.

A public version of RAPTOR can be found at
http://www.oregon.gov/OMD/OEM/Pages/plans_train/RAPTOR.aspx

Oregon Department of Geology and Mineral Industries (DOGAMI)
http://www.oregongeology.org/

DOGAMI has many partnerships and efforts that help protect people and property from earthquakes and tsunamis. Some 2014 accomplishments include the following.

WSSPC Policy Recommendation 12-2 Developing Earthquake Risk-Reduction Strategies

DOGAMI started the year by issuing the very successful press release titled **"**Lessons of preparedness from historic earthquake: *January 26 marks the 314th anniversary of the last great Cascadia Subduction Zone earthquake, and a great time to prepare."* Continuous ongoing media efforts include filming with Oregon Public Broadcasting on their focus pieces that will be released in 2015, as well as other media and outreach. Increasing awareness through media coverage and outreach encourages citizens, governments, and businesses to prepare.

DOGAMI completed a pilot Cascadia earthquake risk study on hospitals, water systems, transportation, and lifeline interdependency for the Oregon Health Authority, which has responsibilities on safe drinking water and hospital preparedness. This effort has fundamentally improved our understanding of what steps are needed by communities to improve earthquake resilience.

DOGAMI has started to improve our understanding of Oregon's liquefaction hazards and risk. This effort involves partnering with researchers and critical infrastructure stakeholders with important assets to the state on potentially liquefiable soils, and has included the identification of Oregon's priority needs. Oregon's top priorities have been publically discussed with geology professionals (February 2014) and at the Oregon's interagency hazard mitigation team (October 2014). The National Research Council's liquefaction committee, which includes DOGAMI personnel, will issue its findings in early 2015.

DOGAMI personnel assisted the NIST-funded Applied Technology Council ATC 102 Project, Development of NEHRP Research and Implementation Earthquake-Resilient Lifelines Roadmap.

DOGAMI is assisting the Department of Land Conservation and Development and other state agencies with Oregon's update of the state natural hazard mitigation plan.

DOGAMI is represented on the Cascadia Region Earthquake Workgroup board and participated in CREW activities (www.*crew.org*). CREW jointly sponsored the *Cascadia Earthquake Readiness Workshop* with the Society of American Military Engineers (SAME) held at the Centralia College in Washington at the Energy and Construction Best Practices Summit.

WSSPC Policy Recommendation 14-4 Identification and Mitigation of Unreinforced Masonry Structures

On June 14, 2014, DOGAMI presented seismic hazard information to the Portland City Council at their URM work session to help encourage potential URM ordinances regarding earthquakes and seismic hazards. A recording of the work session is at:
http://www.portlandoregon.gov/article/494754

WSSPC Policy Recommendation 13-10 Joint Policy for the Evaluation and Seismic Remediation of School Buildings

DOGAMI was involved with seismic safety of schools and building resilience in critical infrastructure including:

- DOGAMI personnel participated in the 2014 EERI/10th NCEE Conference in Alaska, including co-organizing the technical session on seismic school safety and participating in the EERI schools workshop.
- DOGAMI continues to partner with the Oregon Department of Education and school districts to submit reports of annual seismic upgrades to public schools. The third year reports were submitted by September 30, 2014 (*http://www.oregongeology.org/sub/projects/rvs/activity-updates/status.htm*l). In addition, the Oregon Department of Education reports seismic update information on their annual report cards of school districts.

WSSPC Policy Recommendation 14-1 Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources
WSSPC Policy Recommendation 13-1 Rapid Tsunami Identification and Evacuation Notification

As part of the National Tsunami Hazard Mitigation Program (NTHMP), DOGAMI worked with Oregon State University, the Pacific Geoscience Centre in Canada and Oregon Health, Science University (OHSU) and Virginia Institute of Marine Science, Center for Coastal Resources Management to complete tsunami inundation maps and data for the entire Oregon coast. All maps were released by 2013. In 2014, GIS tsunami data releases included tsunami digital point data for vorticity, minimum flow depth, and momentum flux for these areas:

- Clatsop project area, Clatsop County
- Tillamook County
- Central Coast project area, Coos, Douglas, Lane, and Lincoln Counties
- Bandon project area, Coos and Curry Counties
- Coos Bay project area, Coos County

DOGAMI worked with a broad stakeholder group to develop, publish and distribute a maritime guidance brochure called "Tsunami! What Oregon boaters need to know". You can download the brochure from *http://www.oregongeology.org/tsuclearinghouse/maritime.htm*.

DOGAMI completed a City of Seaside and Gearhart Evacuation Analysis, which includes models for timing of evacuation from tsunami inundation zone in a variety of scenario including with and without tsunami vertical evacuation structures in the inundation zone. Maps will be released as publications in 2015.

DOGAMI has worked with California and its ASCE partners on evaluating PTHA (probabilistic tsunami hazard analysis) approaches for the Cascadia margin. This work has helped Oregon to evaluate probabilities of the 7 statewide tsunami scenarios. It has informed the evaluation of these scenarios by a State advisory committee for a revision of the official tsunami inundation zone limiting construction of new critical, essential, hazardous, and large occupancy facilities under the Oregon Building Code. A report from our University of Washington partners is at: *https://digital.lib.washington.edu/researchworks/handle/1773/25916*.

DOGAMI continues to foster dialogue and critical feedback from local stakeholders regarding the effectiveness of tsunami mitigation products (e.g., tsunami evacuation maps) through the Tsunami Advisory Council, including to the hospitality industry. Oregon's outreach program, Tsunami Outreach Oregon (TOO) promotes sustainable, volunteer-driven community organizations to spearhead tsunami outreach, promoting a culture of tsunami preparedness along the length of Oregon's coast. Building on the FY2009-2012 work, TOO will continue to reach out to interested communities to support their tsunami educational and preparedness activities.

Last, DOGAMI continues to participate in several national, regional and state seismic policy commissions and workgroups.

- National Tsunami Hazard Mitigation Program (NOAA)
- Cascadia Regional Earthquake Workgroup (FEMA)

- Western States Seismic Policy Council (WSSPC)
- Oregon State Seismic Policy Advisory Commission (OSSPAC)
- Cascadia response plan coordination meetings with FEMA

Oregon Seismic Safety Policy Advisory Commission (OSSPAC)
http://www.oregon.gov/OMD/OEM/Pages/osspac/osspac.aspx

WSSPC Policy Recommendation 13-4 Seismic Provisions in the 2012 International Building Codes

The 2014 Oregon Structural Specialty Code, which adopts the 2012 IBC, went into effect on July 1, 2014.

WSSPC Policy Recommendation 12-2 Developing Risk Reduction Strategies
WSSPC Policy Recommendation 12-1 Earthquake Planning Scenarios

Under the leadership of Dr. Scott Ashford, Oregon State University, and Dr. Jeff Rubin, Tualatin Valley Fire and Rescue, the Oregon Resilience Task Force developed priority recommendations from OSSPAC's 2013 Oregon Resilience Plan (ORP). The Task Force, which included membership from the OSSPAC, issued their recommendations on September 30, 2014. Recommendations, which will be considered by the 2015-17 Legislature, focus on increasing resilience in these eight areas:

- Oversight: Resilience Advisor to Governor
- Transportation
- Land Use
- Energy
- Critical Facilities & Seismic Rehabilitation Grants
- Research
- Training & Education
- Water & Wastewater

More information can be found at: *http://www.oregon.gov/OMD/OEM/Pages/Resilience-Taskforce.aspx.*

In addition, OSSPAC has been soliciting testimony to ask the 2015-17 Legislature for an ORP version 2.0 that deals with community resilience. OSSPAC has received input from historic preservationists, apartment owners who have retrofitted their URMs, and an economist view of the fiscal side of resilience. OSSPAC will soon consider mass care, sheltering and housing following a Cascadia event.

Submitted by: Althea Rizzo, Earthquake, Tsunami and Volcano Program Coordinator, Oregon Emergency Management; Yumei Wang, Geotechnical Engineer, and George Priest, Tsunami Hazards Geologist, Department of Geology and Mineral Industries, and Jay Wilson, Chair, OSSPAC.

Utah Geological Survey, Utah Seismic Safety Commission, University of Utah Seismograph Stations, and Utah Division of Emergency Management

UTAH GEOLOGICAL SURVEY

Paleoseismic Investigations

In 2014, the Utah Geological Survey (UGS) continued an active program of paleoseismic research on Utah Quaternary faults. The UGS and U.S. Geological Survey (USGS) Earthquake Hazards Program (Golden, Colorado) continued to cooperate on paleoseismic trenching investigations on the Provo segment of the Wasatch fault zone (WFZ) at Flat Canyon and Dry Creek. Dr. Scott Bennett, USGS Mendenhall Fellow, was principal investigator at both sites as part of an investigation into Holocene structural segmentation of the WFZ. The UGS provided technical and logistical support for both trenching investigations. The UGS conducted a paleoseismic trenching investigation near the southern end of the Salt Lake City segment of the WFZ at Corner Canyon. This trench study supplemented the investigation into WFZ Holocene fault segmentation; Dr. Bennett and USGS colleagues assisted the UGS with logging and interpretation of the Corner Canyon trenches. All three investigations are in various states of completion, with most waiting on 14C and/or luminescence dating results.

Newly acquired high-resolution LiDAR data (0.5-meter) are permitting detailed remapping of portions of the WFZ. In 2014, new mapping was initiated on the Malad City, Clarkston Mountain, Collinston, Salt Lake City, Levan, and Fayette fault segments. The UGS will use the new mapping to update the *Utah Quaternary Fault Database*, USGS *Quaternary Fault and Fold Database of the United States*, and to update or create new surface-fault-rupture hazard maps showing special study zones for development along the WFZ. Additionally, the UGS is using the new LiDAR data to make detailed maps of segment boundaries, and to investigate landslides along the trace of the WFZ. The new LiDAR data also confirmed the discovery of a previously unrecognized, basin-floor, Quaternary-active fault, first identified on five-meter auto correlated digital elevation models during mapping for a hydrologic study of Goshen Valley. The newly named Goshen Valley fault is 7.3 to 8.3 miles long, displaces Lake Bonneville sediments (< 15 kyr), and exhibits 1.9 – 6.2 m of vertical displacement.

Utah Valley University professors and students in consultation with UGS geologists used a combination of existing consultant's trenches (excavated for an earlier surface-fault-rupture hazard investigation) and natural exposures along stream drainages to investigate the earthquake history of structures on the Traverse Ridge salient between the Salt Lake City and Provo segments of the WFZ. These structures may provide a link between the two WFZ segments; dome of the structures show evidence for as many as three surface-faulting paleoearthquakes.

Earthquake Working Groups
WSSPC Policy Recommendation 12-2 Developing Earthquake Risk Reduction Strategies

The UGS held meetings of the Utah Quaternary Fault Parameters Working Group (UQFPWG), and the Working Group on Utah Earthquake Probabilities (WGUEP) in 2014. The UQFPWG held its meeting on February 5th in Salt Lake City. Working Group members reviewed current and upcoming paleoseismic research activities in Utah, reviewed new slip-rate and recurrence-interval estimates for faults studied over the past year, and revised their list of highest priority faults for future paleoseismic studies.

The WGUEP met on February 5th and 6th, also in Salt Lake City. Working Group members reviewed the current draft of the WGUEP report, identified outstanding issues requiring further Working Group attention, and discussed the future rollout of the report. The WGUEP's goal is to have a completed draft report ready before the end of the year to submit to outside review, with an anticipated rollout to the public in April 2015.

Utah Aerial Imagery and Low-Sun-Angle Photography

Over 88,000 aerial photographs of Utah are now available for searching, viewing, and downloading using the UGS Aerial Imagery Collection online application at *https://geodata.geology.utah.gov/imagery/*. The collection includes low-sun-angle aerial photographs of the Wasatch, Hurricane, Washington, West Valley, West Cache, and East Cache fault zones, along with vertically oriented photographs from across the state, many covering these and other faults. Detailed information about the UGS Aerial Imagery Collection is available in Bowman (2012) and at *http://geology.utah.gov/online/aerial_photos/index.htm*.

Basin and Range Province Seismic Hazard Summit III

The UGS and the Western States Seismic Policy Council, in conjunction with the Utah Division of Emergency Management, the Utah Professional Geologists Licensing Board, the Utah Professional Engineers and Land Surveyors Licensing Board, the USGS, the Intermountain Section of the Association of Environmental and Engineering Geologists, the University of Utah Seismograph Stations, and the Utah Seismic Safety Commission will convene a Basin and Range Province Seismic Hazards Summit III (BRPSHSIII) to bring together geologists, seismologists, geodesists, engineers, emergency managers, and policy makers to present and discuss the latest earthquake-hazards research, and to evaluate research implications for hazard reduction and public policy in the Basin and Range Province. BRPSHSIII is scheduled for January 12-17, 2015, in Salt Lake City, and will include a short course on characterizing hazardous faults, a USGS Workshop on Evaluation of Hazardous Faults in the Intermountain West (IMW) Region, four days of technical sessions with more than 30 invited speakers, and will conclude with a field trip along the Salt Lake City segment of the Wasatch fault. Additional technical details and registration information for the summit are available online at *http://geology.utah.gov/ghp/workgroups/brpshs.htm*.

UTAH SEISMIC SAFETY COMMISSION
WSSPC Policy Recommendation 13-10 Joint Policy for Evaluation and Seismic Remediation of School Buildings

The Utah Seismic Safety Commission continued its efforts in reducing Utah's risk from seismic hazards by continuing to investigate school seismic safety through rapid visual screening of selected schools and educating the public about the dangers from unreinforced masonry buildings, of which Utah has one of the highest number in the Western United States. The Existing Buildings Subcommittee is currently reviewing a draft update of The Utah Guide for the Seismic Improvement of Unreinforced Masonry Dwellings for publication in 2015.

UNIVERSITY OF UTAH SEISMOGRAPH STATIONS
WSSPC Policy Recommendation 14-3 Earthquake Monitoring Networks

The University of Utah Seismograph Stations (UUSS) continues to improve the capabilities of the Utah regional seismic network to detect, locate, and characterize earthquakes in Utah. During 2014, three new seismic stations were installed: (1) a new regional station in central Utah with broadband sensors, (2) a new regional station in southwestern Wyoming with broadband sensors, and (3) a Netquakes strong-motion instrument in Salt Lake City, Utah. A summary of the 2014 seismic activity is available in Quarterly Reports (Burlacu *et al.*, 2014a, b) on the UUSS webpage *http://www.quake.utah.edu/EQCENTER/QUARTERLY/quarterly.htm*.

Notable seismic events in the Utah region during 2014 include a cluster of over 50 earthquakes on the Utah Nevada border near St. George, Utah, in January, including two ML ≥ 4.0 quakes. These events were felt in the St. George region. Two additional notable events, the April 19 ML 3.2 Tooele earthquake and the June 11 ML 3.3 Bountiful earthquake, were widely felt throughout the Salt Lake Valley and along the central Wasatch Front. An ML 4.2 earthquake occurred on June 28 on the northwest edge of the Wasatch Plateau near Mount Pleasant, Utah, and was felt there and in other nearby towns.

In late March an energetic sequence of earthquakes began near Challis, Idaho, in an area 30-40 km northwest of the 1983 M 6.9 Borah Peak earthquake surface faulting. This sequence included several M ≥ 3.5 quakes, the largest of which was an M 4.8 on April 13. In April UUSS partnered with the Idaho Geological Survey, Boise State University, the Montana Bureau of Mines and Geology, and the U. S. Geological Survey to deploy a temporary local seismic network near Challis. By late summer, the sequence had tapered off and all but one of the local array stations were removed. Results from analyses of the local data will be presented at the 2014 American Geophysical Union Meeting (Stickney *et al.*, 2014).

In research efforts, we continued analyses of (1) an M 4.8 earthquake that occurred on Sept. 21, 2013 in the upper mantle beneath the Wind River Range in southwestern Wyoming (Pechmann *et al.*, 2014) and (2) seismo-acoustic signals from the April 2013 Bingham Canyon Mine landslides and earthquakes induced by these landslides (Pankow *et al.*, 2014). We also continue efforts to detect and locate mining induced seismicity (MIS) in the context of improving ground control within the mining environment. Two studies were published this year. In the first, MIS recorded above the Trail Mountain mine was relocated and found to concentrate in the

roof along the gate roads for much of the mining of Panel 13 (Boltz *et al.*, 2014). However, at the end of the panel the seismicity merged across the width of the panel, which we hypothesized might be due to the geology immediately above or below the seam or to the effects of the overburden. In the second study, a cross-correlation detector was used to expand the seismicity catalog for the time and area of the 2007 Crandall Canyon mine collapse (Kubacki et al., 2014). The additional events and precise locations clearly show how the seismicity migrated before and after the M 3.9 collapse event.

In other research efforts, in collaboration with the Colorado School of Mines, we used rocket motor detonations in Utah's west desert to monitor time-lapse seismic velocity changes within Utah and eastern Nevada (Kanu *et al.*, 2014). We found maximum path average velocity changes of 0.2% over a four-month time period. Two junior high school teacher interns who worked with us over the summer found a possible correlation between levels of the Great Salt Lake and seismicity rates, suggesting that lake level increases may induce seismicity (Whidden *et al.*, 2014). We also completed final technical reports for two USGS-NEHRP projects, one on the paleoseismology of the northern segments of the Great Salt Lake fault and the other on paleoseismology studies of Utah Lake (Dinter and Pechmann, 2014; Dinter, 2014). The most important result from these two projects was the discovery of massive debris flows (up to 16 m thick) beneath Utah Lake that apparently originated in the Wasatch Range and were likely triggered by large Holocene earthquakes.

In support of the UGS-USGS Working Group on Utah Earthquake Probabilities in 2014, UUSS seismologists completed the development of a moment magnitude catalog for the Utah region, calculated earthquake recurrence rates for the region based on this catalog, and took the lead role in a comparison of seismic moment rates estimated from crustal deformation measurements ("geodetic moment rates") with geological/seismological moment rates predicted by the WGUEP model. The new moment magnitude catalog unifies existing UUSS and USGS catalogs for the Utah region and incorporates results of a systematic review and editing of the historical earthquake record, thus facilitating authoritative earthquake hazard and risk analyses. To obtain the best estimate of the moment magnitude, **M**, for each earthquake, eighteen region specific conversion relationships to **M** (based on general orthogonal regressions) were developed for an assortment of instrumental magnitudes and shaking-intensity size measures. The recurrence rates based on this catalog were corrected for the bias caused by magnitude uncertainty using a refined state-of-the-art methodology. Full details are documented in an appendix (Arabasz *et al.*, 2014) to the WGUEP report.

UTAH DIVISION OF EMERGENCY MANAGEMENT

Catastrophic Earthquake Plan

FEMA and DEM are continuing their work on a joint FEMA Region 8 and State of Utah Catastrophic Earthquake Plan. Two years prior to the 2012 Great Utah ShakeOut, FEMA and the Utah Division of Emergency Management started gathering detailed data on the resource shortfalls of the State following a major earthquake. Meetings were held with representatives from city, county, state and federal agencies along with some private sector partners. The two-year process developed the joint response plan that was exercised in the 2012 Full Scale Exercise

as part of the ShakeOut. The current planning process involves the same participants and will better define the short falls of the state following a major earthquake. The end result of this planning process is to have all of the initial FEMA "push packages" of needed resources immediately deployed into the disaster area.

Division of Emergency Management – Utah Seismic Safety Commission Partnership

The Utah Division of Emergency Management (DEM) is partnering with the Utah Seismic Safety Commission (USSC) on their Safety Assessment Program (SAP). The program is to certify that volunteer engineers, architects, and International Code Council (ICC) inspectors are qualified to evaluate the safety of post-earthquake buildings. Volunteers must complete a full day of classroom and fieldwork in ATC-20 training. Additional, volunteers must be professionally licensed or be a certified ICC inspector and complete the FEMA Independent Study Course 100B, Incident Command System to receive the SAP certification. DEM will be the administrator of the SAP program which involves the issuing of certification cards and certificates and tracking volunteer re-certifications for the Commission. DEM and the Utah Division of Risk Management provide the ATC-20 training and other educational materials for the certifications. To date, over 150 qualified volunteers have been trained. DEM provides ATC-20 training for organizations that desire the training, but do not qualify for the certification.

The 2013 Utah Legislature provided funding through the Governor's Office to the Utah State Office of Education (USOE) to conduct Rapid Visual Screening (RVS) of school buildings throughout the state. An RVS Authority was created through the Governor's Office of Management and Budget (OMB). The Authority is made up of representatives from large, moderate and small schools districts, the USSC, OMB and USOE. The Authority has been tasked with the development of a program to collect RVS data for schools districts that have not been recently evaluated. Previously completed RVS studies will be provided to the Authority by either the school districts or the USOE. The Authority will supervise the RVS data collection by a private contractor and provide a report of the findings to the Governor and the Legislature.

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Submitted by: William Lund and Steve Bowman, Utah Geological Survey
Kris Pankow, University of Utah Seismograph Stations
and Bob Carey, Utah Division of Emergency Management.

Washington State Report

WSSPC Member Agencies:

Washington State Military Department, Emergency Management Division (EMD)

Washington State Department of Natural Resources, Division of Geology & Earth Resources (WDGER)

Supporting Agencies:

Pacific Northwest Seismic Network (PNSN)

Washington State Department of Transportation (WSDOT)

Washington State has continued to focus on reducing the impact of earthquakes and other geologic hazards and increasing state and community resilience through aggressive public education efforts and by providing the necessary tools for communities to become resilient and reduce or eliminate earthquake risks.

Activities include the following accomplishments for Fiscal Year 2014:


The State of Washington

Proclamation

Washington State Disaster Preparedness Month
&
NOAA Weather Radio Awareness Month

- October 2014 was proclaimed by Governor Jay Inslee as "*Washington Disaster Preparedness Month & NOAA Weather Radio Awareness Month*".

- On October 16th at 10:16 a.m., Washington State joined with the rest of the west coast as well as states and countries across the world by participating in the Great ShakeOut earthquake drill. During the third year of the Great Washington ShakeOut more than 1 MILLION Washingtonians registered participation in the drill. This is an increase of 361,240 participants from the inaugural Washington ShakeOut in 2012 and an increase of 210,634 from the 2013 Washington ShakeOut.

  - As part of the Washington ShakeOut, EMD and the outer coastal counties of Pacific, Grays Harbor, Jefferson, and Clallam conducted a **Tsunami Warning Communications Test** and encouraged community-wide evacuation drills. This included activation and broadcast of the actual tsunami warning tone across 56 All-Hazard Alert Broadcast (AHAB) sirens located along the entire outer coast.

  - During the Washington ShakeOut, coastal schools and coastal communities will practice drop, cover, and hold earthquake safety measures followed by tsunami evacuation drills.

- Earthquakes pose substantial risks to transportation infrastructure in Washington State. As part of its bridge preservation program, WSDOT uses seismic retrofit of bridges to mitigate the potential risks associated with these events. The purpose of the Seismic Retrofit program is to minimize and avoid catastrophic bridge failures by strengthening bridges and structures to resist future earthquakes.

SR 99 Aurora Ave. Bridge Approach span piers – Design Visualization of retrofit

Bridges in the Seismic Retrofit Program (as of March 2014)	
Completely Retrofitted	284
Partially Retrofitted	120
Needing Retrofitting	477
Under Contract	32
Total	913

- Washington State Emergency Management enlisted the assistance of the University of Washington's Hazards Mitigation Institute and the Washington State Department of Health along with professional associations such as the Washington Association of Building Officials, Structural Engineering Association of Washington, Washington Chapter of the American Institute of Architects to enhance existing post-earthquake building inspection processes.

  This year-long effort culminated in an actionable report that will be implemented in the near future. Additionally, the project resulted in the development of a multi-agency database that can be used to facilitate rapid deployment of qualified and trained professionals to jurisdictions and tribes needing assistance assessing earthquake-damaged structures.
- The Cascadia Region Earthquake Workgroup (CREW), through FEMA's State Assistance Funding, supported Washington State's media partnerships with news outlets across the state for the Great Washington ShakeOut earthquake and tsunami drills. Building upon last year's successes, CREW and contractor, Rich Marketing, positioned the Great Washington ShakeOut in the appropriate media markets, at the appropriate times, and at the best price.

  This resulted in associated media partners matching strategic investments made by CREW and producing and airing brief segments with local television personalities promoting the Great Washington ShakeOut and encouraging viewers/listeners to register for the drill and take additional steps to become better prepared for earthquake disasters.

- Through support from FEMA's National Earthquake Training Assistance Program (NETAP), numerous training activities occurred throughout Washington State during this fiscal year. This training program directly resulted in 190 public and private industry professionals receiving mitigation and response information that can be used to improve community resilience before and after an earthquake.

  Staff from Washington Emergency Management supported NETAP contract personnel in deliveries of the Rapid Visual Screening of Buildings for Potential Seismic Hazards (FEMA 154), Post-Earthquake Safety Evaluation of Buildings (ATC 20), Earthquake Mitigation for Hospitals (FEMA P767), and Reducing Risks of Nonstructural Earthquake Damage (E74) courses that were focused on varying geographic regions of Washington. These included:
  - F154/ATC20 – 112 trained in Aberdeen, Spokane, and Tacoma
  - P767 – 24 trained in Everett
  - E74 – 52 trained in Aberdeen, Spokane, and Tacoma

  EMD continues to partner with the University of Washington, Pacific Northwest Seismic Network to better understand regional earthquake hazards and to support risk reduction policies and hazard mitigation. The PNSN is based at the University of Washington, with additional staff located at the Cascade Volcano Observatory in Vancouver, at the University of Oregon, and at the Hanford Reservation in Richland, Washington. The PNSN also hosts the Seattle Field Office of the USGS Earthquake Program and benefits greatly from direct and indirect contributions of their USGS colleagues. The following is an overview of related PNSN activities:

  - ShakeCast: The PNSN and Washington EMD are partnering to help integrate USGS developed ShakeCast software at the State EOC. The program is currently used to upload ground motion data and initiate HAZUS loss estimates with PNSN generated input ground motions. ShakeCast capabilities have been described to a variety of State Agencies and lifeline provides in Washington State during a presentation by PNSN at the Committee on Homeland Security's Infrastructure Protection Subcommittee meeting. A pilot project between the PNSN and University of Washington facility engineers has characterized a dozen structures of various construction types on the University of Washington campus. ShakeCast now produces tables of probable damage state for these buildings whenever a ShakeMap is generated in the Pacific Northwest.

  - The PNSN remains active in The Contingency Planners and Recovery Managers (CPARM) group and the Cascadia Region Earthquake Workgroup (CREW). PNSN assisted in the development of the CREW Cascadia Subduction Zone Earthquakes: A magnitude 9.0 earthquake scenario published in 2013.

  - PNSN provided tours and lectures on earthquake hazards to thousands of school children this year as well as provided speakers for dozens of organizations and public lectures. The PNSN provided interviews, consultations, and information services to citizens and media providers in the region and throughout the world about earthquake and volcano hazards in the Pacific Northwest.

- The PNSN has joined with Cal Tech and UC Berkeley in a research program to develop a prototype West Coast Earthquake Early Warning System (EEW) with support from the Moore Foundation and the USGS. A workshop was held at UW in February to introduce the program to businesses, emergency managers and other regional stakeholder organizations. The workshop was completely filled and over a dozen follow up meetings with company and agency managers have been held. A majority of these organizations have agreed to attend another workshop this spring to explore founding a University/Industry Cooperative Research Center (I/UCRC). The EEW consortium has submitted a proposal to NSF to support development of this center. UW also co-hosted an international EEW workshop at UC Berkeley in 2014.

- The University of Washington and the PNSN have also been awarded a multi-year, interdisciplinary Science, Engineering and Education for Sustainability (SEES) grant to characterize ground motions and impacts of a Magnitude 9 Cascadia Subduction Zone earthquake. The goal is to bring state of the art science to bear on developing our understanding of the impacts to inform engineers, policy makers, and the public to implement appropriate mitigation and preparedness actions to build regional resilience. EMD and DNR will be collaborating with the UW, PNSN, and other partners on this effort.
- Washington State/Local Tsunami workgroup meetings were conducted this past year. Workgroup agenda items included: Design and Implementation of Vertical Evacuation Safe Havens along the Washington coast, Tsunami Public Education Train-the-Trainer Courses, new public education products, evacuation and assembly area signage, NOAA/National Weather Service Updates, Distribution of NOAA Weather Radios to Low Income Families, Training for Hospitality Industry Employees, the Great Washington ShakeOut and community evacuation drills, and future NTHMP funding.

- The Washington Department of Natural Resources (DNR) has continued development of the Washington State Geologic Information Portal which has multiple geologic themes including a Natural Hazards Interactive viewer.
  https://fortress.wa.gov/dnr/geology/?Theme=natural_hazards

- The geologic map theme includes layers of suspected active faults, reconnaissance liquefaction susceptibility and NEHRP site class maps, the earthquake catalogue of the Pacific Northwest Seismic Network, landslides, and tsunami inundation maps, as well as statewide geologic mapping.
  http://www.dnr.wa.gov/ResearchScience/Topics/GeosciencesData/Pages/geology_portal.aspx

- Other geologic hazard themes include the Interactive Tsunami Evacuation Map with an address locator and links to the tsunami evacuation brochures, 7 of which were updated to an easier-to-read format with an air photo base.
  https://fortress.wa.gov/dnr/geology/?Site=tsunami_evac

- DNR, EMD, and Oregon DOGAMI also collaborated to create a Smartphone app for tsunami evacuation maps available at:
    - iPhone: *http://itunes.apple.com/us/app/tsunamievac-nw/id478984841?mt=8*
    - Android: *https://play.google.com/store/apps/details?id=org.nanoos.tsunami&hl=en*

- DNR has been assessing earthquake-induced landslide and liquefaction hazards in tsunami inundation zones as a guide to more robust evacuation planning along Washington coastal areas. Recent publications have been completed:

    - Landslide and liquefaction maps for the Ocean Shores and Westport peninsulas, Grays Harbor County, Washington—Effects on tsunami inundation zones of a Cascadia subduction zone earthquake, by S. L. Slaughter, Timothy J. Walsh, Anton Ypma, and Recep Cakir. 2014. Three color sheets: 39 x 36 in., scale 1:18,000, plus 26 p. text.

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Policy Recommendations 13-1: Rapid Tsunami Identification and Evacuation Notification

EMD continued to partner with Federal Signal, Inc. to upgrade the All Hazard Alert Broadcast (AHAB) Siren System that provides both tone and voice alert notification to at-risk communities for any hazardous situation, including tsunami warnings. The primary focus of the past year has been to continue upgrading the satellite telemetry of the existing 59 AHAB sirens

have been placed in at-risk population areas along the coast. Upgrades have been completed in all areas, with the exception of Grays Harbor County, and that upgrade is currently in progress.

- The Consolidated Reporting of Earthquakes and Tsunamis (CREST) is a National Oceanic and Atmospheric Administration (NOAA) funded project to improve the nation's ability to rapidly assess the likelihood and severity of a damaging earthquake-generated tsunami. The PNSN operates 13 CREST stations in Washington and Oregon with digital broadband seismometers and strong motion accelerometers. Real time data from these stations is made available to the National Earthquake Information Center and the Alaska Tsunami Warning Center. This year NOAA has withdrawn support for the maintenance and operation of these stations. The PNSN and USGS are working together to identify resources that can be tapped to continue to operate these essential seismograph stations.

- The PNSN has been working within the ANSS to acquire real-time geodetic monitoring (high-sample-rate GPS positioning) in the Pacific Northwest. This advance will significantly strengthen the region's ability to rapidly detect the crustal displacement signals that are associated with tsunami generation, facilitating more rapid and accurate regional warnings.

- The PNSN has also set a long-term goal of providing early warning for strong shaking. With 1.8 million dollars of private support from the Moore Foundation, the University of Washington and PNSN will build a prototype Earthquake Early Warning System for the Cascadia Region. This is part of a larger West Coast Earthquake Early Warning initiative supported by the Moore foundation with a 7 million dollar grant involving research groups at Cal Tech, UC Berkeley, UW, and the USGS. The early warning system could provide up to three or four minutes of warning that a Cascadia megathrust earthquake is underway before the shaking reaches the Portland-Seattle urban corridor. Shorter-lead-time warnings would be provided for crustal earthquakes. The experimental system will be developed by 2014. Long-term federal support would be required to develop this experimental capability into an operational warning system.
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Policy Recommendation 13-3 and 13-6: Post-Earthquake Technical Clearinghouses & Post-Earthquake Information System

- The Washington Department of Natural Resources-Division of Geology and Earth Resources (DNR) with EMD has evaluated the different earthquake clearinghouses and are currently evaluating how best to establish an earthquake clearinghouse in Washington. After initial testing of an earlier Microsoft SharePoint-based system, it was determined to be ineffective in rapidly registering off-site and dispersed contributors that would need access in remote locations.

  Over the course of 2012-13, Washington DNR conducted an assessment of existing earthquake clearinghouse models that exist in the United States and provided a report entitled "*Strategies for Establishing a Washington State Post Earthquake Information*

Clearinghouse" that provides recommendations for establishing a more effective and coordinated repository.

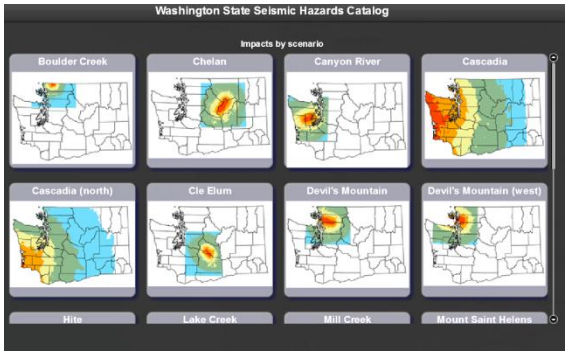
Funding needs to be identified in order to advance the recommendations included within the report.

Policy Recommendation 13-4: Seismic Provisions in the 2012 International Building Code

- The State of Washington has adopted the 2012 edition of *International Building Code*, including Appendix E, as stated in Washington Administrative Code (WAC) 51-50-003.

Policy Recommendation 12-1: Earthquake Planning Scenarios

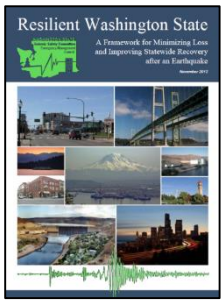
- EMD in collaboration with DNR, USGS, FEMA Regions VIII & X, URS Corporation, and Western Washington University continued the development of an interactive digital Earthquake Scenario Catalog for Washington State hosted by DNR. The purpose of this project is to provide the state and local jurisdictions with additional resources for use in hazard mitigation and response planning for earthquake events as well as to facilitate better exercise design. *https://fortress.wa.gov/dnr/SeismicScenarios*



The earthquake scenario catalog consists of 20 USGS ShakeMaps developed by Dr. Art Frankel coupled with FEMA HAZUS loss estimations that were completed to ascertain impacts from these events. The online reports also include indices of community vulnerability and exposure for each scenario event. Additionally, fact sheets were crafted developed for each scenario and are available for download. Dr. Frankel will also be producing state of the art ground motion modeling for a variety of Cascadia Subduction Zone Scenarios as part of the UW SEES program. This will include basin and soil effects to more accurately portray the distribution of shaking resulting from these scenario earthquakes. Once available, this updated information will be incorporated into the scenario catalog.

Policy Recommendation 12-2: Developing Earthquake Risk-Reduction Strategies

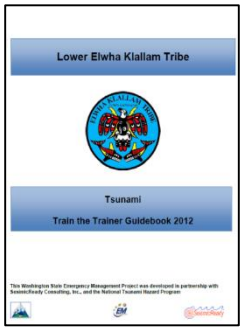
- The Washington State Seismic Safety Committee (WASSC), co-chaired by the Director of WA EMD and the WA DNR State Geologist, completed a project entitled the "Resilient Washington State Initiative." The final report was published and released in November 2012. The RWS Initiative is a strategic planning process for achieving state-level resilience with respect to earthquake hazards. The first state-level assessment and resilience framework of its



kind, the report identifies actions and policies before, during, and after an earthquake that can leverage existing policies, plans and initiatives to realize disaster resilience to earthquakes within a 50-year life cycle.

The Resilient Washington State Initiative built off a city-level assessment completed in the City of San Francisco by the San Francisco Planning and Urban Research Association (SPUR).

Policy Recommendation 14-1: Improving Tsunami Public Education, Mitigation, and Warning Procedures for Distant and Local Sources



- During 2014, the EMD Earthquake/Tsunami Program and SeismicReady Consulting completed multiple Tsunami Public Education Instructor Train-the-Trainer (T3) Workshops, with participants attending from various coastal Washington jurisdictions. County/Tribe-specific workbooks, presentations, and outreach materials were updated and delivered as a component of this training. The T3 Program provides participants with a basic understanding of fundamental principles and concepts in: Tsunami Science, Tsunami Warning, Tsunami Risk Reduction, and Conducting Community-level Tsunami Public Education.

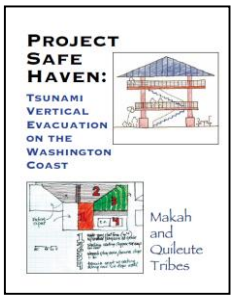
  Participants in local jurisdictions took part in the workshops, which are designed to train a cadre of professionals that are qualified to serve as Tsunami Public Education Instructors at the community level. Attendees included personnel from county and community organizations, as well such as Tribal Council, Emergency Management, Fire Departments, Community Emergency Response Team (CERT), Chamber of Commerce, and volunteer community members.

  - Washington Tsunami Program staff from EMD and DNR supported the Cascadia EarthScope Earthquake and Tsunami Education Program (CTEEP). Through a grant from the EarthScope Program of the National Science Foundation (NSF), CEETEP offered two (2) four-day workshops to foster community engagement of earthquake science and preparedness, and to encourage collaboration and exchange between formal and informal coastal educators in Washington State's coastal communities.

  EarthScope is a multi-decade effort to explore the structure and evolution of the North American continent. It includes seismic, GPS, and other geophysical instruments to monitor the Cascadia Subduction Zone and advance our understanding of the region's geohazards. Each workshop included K-12 teachers, park and museum interpreters, and emergency management educators from coastal areas. Through a problem-solving approach to subduction zone geology, participants learned how: 1) geoscientists developed their current understanding of Pacific Northwest plate tectonics, earthquakes, and tsunamis; 2) EarthScope is advancing knowledge about the active Earth in Oregon and Washington; and 3) collaboration on education, interpretation, and preparedness makes coastal communities more resilient to earthquake and tsunami hazards. Three

days of classroom and interpretive activities on Pacific Northwest geology and EarthScope science were complemented by a field day investigating Cascadia earthquakes and tsunamis, and visits to seismic and GPS installations.

- In March 2013, the collaborative tsunami vertical evacuation planning effort between Washington State EMD, WA DNR, the University of Washington, NOAA's National Tsunami Hazard Mitigation Program, USGS, and FEMA known as "***Project Safe Haven"*** published site-specific hazard assessments to support local implementation of previously identified tsunami safe havens by local communities. This grassroots approach to community and stakeholder engagement on integration of man-made high ground in vulnerable communities that lack available tsunami evacuation options has won numerous awards and led to preliminary planning for all of Washington's tsunami threatened communities.



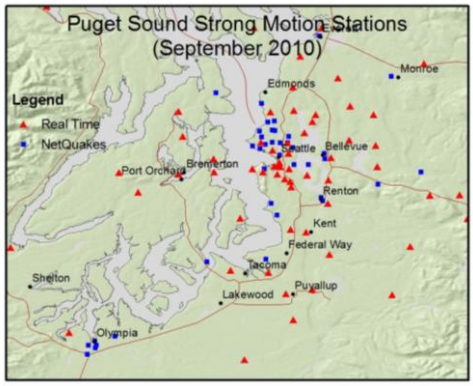
In April 2013, Grays Harbor County voters approved a local levy measure to construct the first tsunami safe haven in the United States. This announcement has received much attention and the school district has garnered local and far reaching press coverage. Moreover, implementing tsunami vertical evacuation would also advance the recommendations with the "Resilient Washington" report.

A multi-agency planning team led by University of Washington researchers and graduate students and Washington Emergency Management Division, including Washington Department of Natural Resources, NOAA, FEMA, USGS, county and tribal emergency management officials, created a community-driven process to identify potential sites for vertical evacuation in these at-risk areas.

On the Westport peninsula, the principal site identified was the location of Ocosta Elementary School, which is approximately at the limit of modeled inundation but also at risk from earthquake-induced ground failure of the adjacent protective ridge. Two previous attempts to pass bond issues to replace the school failed. The current plan to replace the school called for making part of the new school a tsunami vertical evacuation structure that could host as many as a thousand people. This time the bond issue passed…by a 70/30 majority.

The gym is designed to be 30 feet above grade and 55 feet above sea level following earthquake-induced subsidence. Its roof will be accessed from the outside of the four corners and will be capable of holding more than 1,000 people. Ground breaking for the new school is scheduled for fall 2014.

Policy Recommendation 14-3: Earthquake Monitoring Networks
Network Improvements:



- The Earthquake Program Manager represented the National Emergency Management Association (NEMA) at the Advanced National Seismic System (ANSS) National Steering Committee (NSC) meetings. The committee reviewed regional efforts in the United States to enhance seismic monitoring of infrastructure in urban areas as well as latest technologic advances to support the USGS and regional seismic network capabilities to provide emergency managers with products that support rapid response and decision making.

- "NetQuakes" accelerometers have arrived in the Pacific Northwest. Puget Sound area papers printed a request for volunteers to host these instruments and over 1300 Washington residents responded. Using guidance provided by the PNW ANSS Advisory Committee, 75 "high priority" target sites have been selected from the volunteer database. Forty new NetQuakes stations, instruments operating in "triggered" mode, are now in operation (since 9/30/2010). The USGS provided 20 instruments from ARRA funds, 22 with ANSS dollars and an additional 27 from its Multi-Hazard Demonstration Project. In 2012 the Portland Metro Area, including Vancouver Washington, had 14 NetQuakes seismometers deployed and 7 instruments were installed in Spokane. The PNSN will have close to 100 instruments operating by the end of 2012.

- The PNSN is planning to build 25 modern strong motion seismic stations near the Oregon and Washington Coastline to enhance our earthquake early warning (EEW) capabilities. These stations will be co-located where possible with high sample rate GPS stations to allow more sophisticated, real-time modeling of unfolding CSZ earthquakes. This work will be completed in 2014 and 2015.

- Department of Natural Resources- Division of Geology and Earth Resources (DNR) has characterized the shear wave velocity profile at 20 ANSS sites under a NEHRP grant from the USGS

Policy Recommendation 14-4: Identification and Mitigation of Unreinforced Masonry Structures:

- The PNSN and USGS Earthquake Program partners at the University of Washington have provided input into the City of Seattle Unreinforced Masonry Building policy development plan. In 2008, the City contracted with the engineering firm of Reid Middleton to collate information from earlier studies and to fill in knowledge gaps by conducting sidewalk surveys of suspect URMs in parts of the city where data was missing or incomplete. Based upon the results of the survey, the City has organized stakeholder representatives to study potential incentives and regulations that would reduce the risk of losses from these dangerous structures and provide the City Council and Mayor with policy recommendations to be acted upon in 2009. The City has also convened a committee of technical experts to recommend possible retrofit performance standards and provide the City with other technical advice.

  "… [the city] estimates there are up to 1000 URMs in the city, most of which have not been seismically retrofitted…. This is a public safety issue," said Mayor Nickels. "No one's rushing into this decision, and we will deliberate over the coming months before reaching any conclusions. But Seattle is in earthquake country and URM's are our most vulnerable structures. We need to address the issue of safety in these structures in a major quake."

  The Seattle City Council is currently discussing the potential for a mandatory seismic retrofit program.

Policy Recommendation 13-10: Joint Policy for the Evaluation and Seismic Remediation of School Buildings

- A goal that has been on the horizon for several Washington State agencies, including but not limited to the Military Department's Emergency Management Division (EMD), Department of Natural Resources- Division of Geology and Earth Resources (DNR), the Office of Superintendent of Public Instruction (OSPI), and Washington State's Seismic Safety Committee is to systematically evaluate all public school buildings and critical facilities within the Washington in order to establish the seismic risk for each. This will allow for the prioritization of structures in need of seismic retrofitting across the state and permit a strategic, targeted approach for alleviating the risk of potentially dangerous structures.

  The aforementioned agencies, with funding support from FEMA's State Earthquake Assistance Program, began a pilot project starting in April 2010 to evaluate school buildings in two school districts, Aberdeen School District and Walla Walla Public

Schools. The assessments were conducted using a nationally accepted methodology known as *ASCE 31: Seismic Evaluation of Existing Buildings* by volunteer structural engineers from the Structural Engineers Association of Washington.

In addition, the Washington State Office of the Superintendent of Public Instruction is in the process of completing the development of a mitigation plan that will include an initial count of potentially seismically vulnerable schools and a toolkit of potential options.

Submitted by:
Timothy J. Walsh, Chief Geologist-Hazards Section, Washington Department of Natural Resources, Division of Geology and Earth Resource and John D. Schelling, Earthquake Program Manager, Washington Military Department, Emergency Management Division.

Wyoming State Report

WYOMING STATE GEOLOGICAL SURVEY

Induced Seismicity

The Wyoming State Geological Survey (WSGS) completed a study on the potential link between injection and disposal well activities and known earthquakes in Wyoming from 1984 to 2013. The study compared existing earthquake epicenter data to injection and disposal well location data. Earthquake data was acquired from USGS Advanced National Seismic System (ANSS) Composite Earthquake Catalog. Injection and disposal well data and records were attained from Wyoming Department of Environmental Quality (WDEQ) and Wyoming Oil and Gas Conservation Commission (WOGCC).

ABased on the initial results, six sites required secondary investigation. Results from the investigation concluded that five of the sites included earthquakes that were most likely the result of natural causes and unrelated to injection and disposal well activities. The remaining site, near Bairoil, Wyoming, showed no definitive correlation. However, further research is necessary to determine if some induced seismicity has occurred, or if the seismic events were simply natural occurrences. The Open File Report (OFR), titled *Relationships Between Injection and Disposal Well Activities and Known Earthquakes in Wyoming, from 1984 to 2013* can be found at: *http://www.wsgs.uwyo.edu/Research/hazards/Earthquakes-Wells.aspx*

Quaternary Fault Research

The WSGS has completed an exercise to rank and prioritize Quaternary faults in Wyoming that will be used to direct future study. The database was derived from the USGS Quaternary Fault and Fold Database. Rankings were based on maximum magnitude, slip rate, recurrence interval, rupture length, availability of paleoseismic data, and HAZUS-MH loss estimates. The WSGS Wyoming Quaternary fault database will serve as a platform that can be updated as new data for the existing fault structures become available and unpublished data are acquired.

The WSGS has also completed a preliminary surficial geology map of the Chicken Spring area in central Wyoming through funding from the USGS's StateMap program. The map extent includes the Quaternary aged Chicken Springs fault system. The mapping better constrained scarp segment locations and extents and allowed for detailed observation of individual scarp segments in the area. Seventy-two topographic scarp profiles and 13 soil pit descriptions were collected during the completion of the project. An open file report will be prepared over the winter of 2015 based on the field data collected. The report will be available in the summer of 2016. The *Preliminary Surficial Geologic Map of the Chicken Spring Area, Sweetwater County, Wyoming, WSGS Open File Report 14-04* is currently available at: *http://www.wsgs.uwyo.edu/public-info/news/2014/Sept29_2014.aspx*

WYOMING OFFICE OF HOMELAND SECURITY

The Great Wyoming ShakeOut

Wyoming participated in the ShakeOut for the second successive year. Last year Wyoming participated as one of several states in 'The Great Rocky Mountain ShakeOut.' This year Wyoming had its own 'Great Wyoming ShakeOut.' Participation in Wyoming increased 500% in 2014 over the 2013 ShakeOut. In 2013 over 2,000 participated. Wyoming saw a more than 10,000 registered participants in 2014.

We believe this year's Great Wyoming ShakeOut success was the direct result of more wide-spread promotional efforts. The drill was announced/promoted to Wyoming's 23 County Coordinators and the 2 tribes at the quarterly meeting in September. ShakeOut flyers were distributed and the drill was presented to school districts in face-to-face, one-on-one meetings with district superintendents. The ShakeOut link was on the Wyoming Office of Homeland Security's (WOHS) web site and presented through WOHS social media. And lastly, a press release was done, which resulted in several follow-up interviews with media outlets around the state.

Participation in the ShakeOut was viewed as quite successful this year and continued annual participation is expected to occur.

Submitted by:
Seth Wittke, Geologic Supervisor, Groundwater, Geologic Hazards, and Mapping; and Martin Larsen, Wyoming State Geological Survey
Melinda Gibson, State Hazard Mitigation Officer; Wyoming Office of Homeland Security.