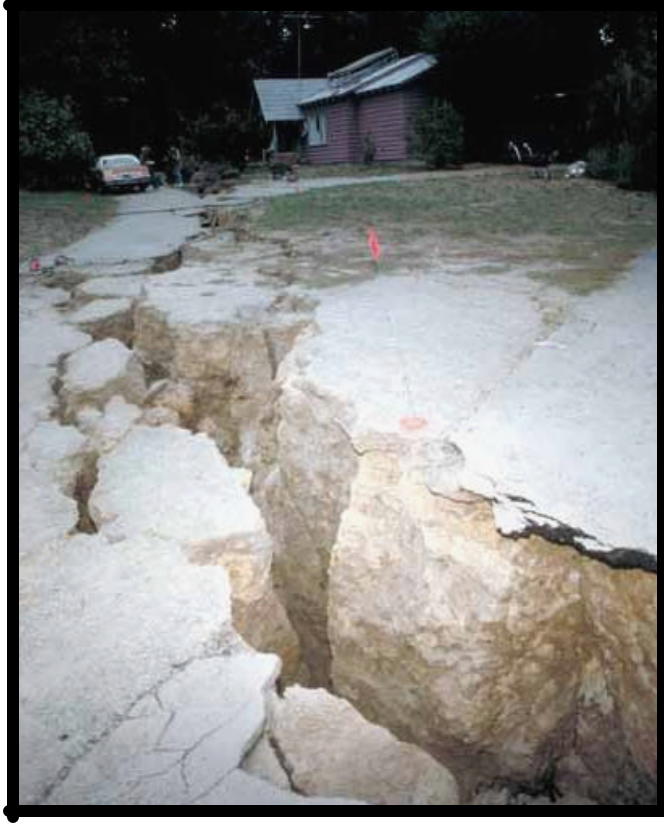
WESTERN STATES SEISMIC POLICY COUNCIL

WESTERN STATES SEISMIC POLICY COUNCIL



2007 Annual Report

2007 WSSPC Annual Report

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1. WSSPC Management and Members

2007 WSSPC Board of Directors and Staff

Chair of the Board of Directors

Rick Allis (2006 - 2008)
Director
Utah Geological Survey
1594 West North Temple, PO Box 146100
Salt Lake City, UT 84114-6100
rickallis@utah.gov

Board Members

John Madden (2006 - 2008)
Director
Alaska Division of Homeland Security and Emergency Management
PO Box 5750
Fort Richardson, AK 99505-5750
john_madden@alaska.gov

Vince Matthews (2006 - 2008)
Director and State Geolo gist
Colorado Geological Survey
1313 Sherman Street, Room 715
Denver, CO 80203-2239
vince.matthews@state.co.us

Dan McGowan (2007 - 2009)
Administrator
Disaster and Emergency Services Division
PO Box 4789
Fort Harrison, MT 59636-4789
dmcgowan@mt.gov

Ken Murphy (2007 - 2009)
Director
Oregon Emergency Management
PO Box 14370
Salem, OR 97309-5062
kmurphy@oem.state.or.us

John G. Parrish (2007 - 2009)
State Geologist
California Geological Survey
801 K Street, Suite 1200
Sacramento, CA 95814-3531
john.parrish@conservation.ca.gov

Henry Renteria (At Large Member 2007 - 2009)
Director
California Governor's Office of Emergency Services
3650 Schriever Ave
Mather, CA 95655
henry_renteria@oes.ca.gov

Executive Director

Patricia Sutch
Western States Seismic Policy Council
801 K Street, Suite 1436
Sacramento, California 95814
tel (916) 444-6816 **fax** (916) 444-8077
psutch@wsspc.org

2007 WSSPC Members and Affiliate Members

WSSPC Members

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
Provincial Emergency Program
British Columbia Geological Survey

California
Governor's Office of Emergency Services
California Geological Survey
State of California 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
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
Department of Public Safety, Office of Emergency Management
New Mexico Bureau of Geology and Mineral Resources

Commonwealth of Northern Mariana Islands
Marianas Office of the Governor, Emergency Management Office

Oregon
Oregon Emergency Management
Oregon Department of Geology & Mineral Industries
Oregon Seismic Safety Policy Advisory Commission

Utah
Utah Division of Homeland Security
Utah Geological Survey
Utah Seismic Safety Commission

Washington
Washington Military Department, Emergency Management Division
Washington State Department of Natural Resources, Division of Geology and Earth Resources

Wyoming
Wyoming Office of Homeland Security/Emergency Management
Wyoming State Geological Survey

Yukon
Yukon Emergency Measures Organization

WSSPC Affiliate Members

Corporate Members:
Degenkolb Engineers
State Farm Insurance Companies

Local Government/Department of Local Government Members
City & County of San Francisco, Department of Building Inspection
Clark County (Nevada) Development Services Building Division

Non-Profit Organization Members
Earthquake Engineering Research Institute (EERI)
Bishop Paiute Tribe Environmental Management Office

University/Department of University Members
Southern California Earthquake Center (SCEC)

2. Financial Reports

Western States Seismic Policy Council

Statement of Activities
November 30, 2007

		Unrestricted
Revenues and Support:		
Membership Dues and Registration	$	40,243
FEMA cooperative agreements		213,219
USGS and other grants		10,000
Miscellaneous		86
Interest income		270
Total Revenues and Support		263,818
Expenses:		
Program services		205,109
Management and general		27,494
Total Expenses		232,603
Increase in Net Assets		31,215
Net Assets at Beginning of Year		128,837
Net Assets at End of Year	$	160,052

From Financial Statements WSSPC FY 06-07, page 3

Western States Seismic Policy Council

Statement of Functional Expenses
Year Ended November 30, 2007

	Program Services	Management and General	Total
Salaries and fringe benefits	$ 96,412	$ 10,712	$ 107,124
Payroll taxes	10,293	1,144	11,437
Professional fees - accounting	0	8,060	8,060
Professional fees - other	7,709	856	8,565
Rent and utilities	18,158	2,018	20,176
Insurance	0	1,186	1,186
Telephone	1,438	160	1,598
Office Supplies and Miscellaneous	3,561	396	3,957
Taxes and licenses	0	60	60
Internet Services	1,324	147	1,471
Meetings and conferences expenses	30,676	0	30,676
Executive committee	15,131	0	15,131
Conference travel	7,384	0	7,384
Bank and Payroll charges	5,882	654	6,536
Newsletter expenses	7,141	0	7,141
Depreciation and amortization	0	2,101	2,101
	$ 205,109	$ 27,494	$ 232,603

From Financial Statements WSSPC FY 06-07, page 4

Western States Seismic Policy Council
FEMA Grant 2006 Income & Expense
August 2006 Through July 2007

	Aug '06 - Jul '07	Annual Budget
Ordinary Income/Expense		
Income		
450.0 · Grants Earned		
460.2 · 2006 FEMA Grants Earned	200,000.00	200,000.00
Total 460.0 · FEMA Grants Earned	200,000.00	200,000.00
Total 450.0 · Grants Earned	200,000.00	200,000.00
Total Income	200,000.00	200,000.00
Expense		
160.1 · Computer Hardware	2,510.63	0.00
165.0 · Office Equipment	658.71	0.00
Total Assets ·	3,169.34	0.00
500.0 · P/R Expenses		
500.1 · Salary	94,608.17	102,630.00
500.2 · Benefits		
500.7 · Employer IRA Contribution		
500.701 · Sutch IRA Employer Contribution	2,180.40	2,143.00
Total 500.7 · Employer IRA Contribution	2,180.40	2,143.00
500.2 · Benefits - Other	4,584.50	9,494.00
Total 500.2 · Benefits	6,764.90	11,637.00
500.3 · Employer Contrib/Taxes	9,209.44	6,454.00
500.4 · Workers' Comp	1,855.55	1,450.00
500.5 · Payroll Service	4,280.00	2,040.00
Total 500.0 · P/R Expenses	116,718.06	124,211.00
506.0 · Prof Fees Accounting	9,000.00	10,700.00
509.0 · Prof Fees Other	13,824.99	5,000.00
510.0 · Office Supplies	2,503.31	2,900.00
515.0 · Telephone	1,645.23	2,200.00
520.0 · Printing	0.00	2,000.00
522.0 · Postage and Delivery	960.02	1,000.00
525.0 · Internet Services	1,545.73	1,417.00
530.0 · Staff Expenses		
530.2 · Staff Mileage	420.86	
530.3 · Staff Transportation	2,259.88	
530.4 · Staff Hotel	2,104.93	
530.0 · Staff Expenses - Other	387.00	3,489.00
Total 530.0 · Staff Expenses	5,172.67	3,489.00

535.0 · Executive Committee Expense		
535.2 · Mileage Exec Comm	227.39	
535.3 · Transportation Exec Comm	7,830.58	
535.4 · Hotel Exec Comm	4,016.29	
530.0 · Exec Comm Expense - Other	0.00	14,720.00
Total 535.0 · Executive Committee Expense	12,074.26	14,720.00
550 · Workshops		
550.2 · EQ Program Managers Meeting	100.35	0.00
Total 550 · Workshops	100.35	0.00
553.0 · 2007 WSSPC - ICC Annual Conf Reno		
553.2 · AC 07 Contractors	175.00	0.00
553.5 · AC 07 Meeting Costs	478.47	0.00
553.6 · AC 07 Printing	2,558.93	0.00
553.7 · AC 07 Shipping	193.02	0.00
Total 553.0 · 2007 WSSPC - ICC Annual Conf Reno	3,405.42	0.00
565.0 · Newsletter		
565.1 · Production	2,415.00	6,000.00
565.2 · Printing	6,148.00	5,312.00
565.3 · Postage	350.42	600.00
Total 565.0 · Newsletter	8,913.42	11,912.00
570.0 · Insurance		
570.1 · Liability Insurance	1,020.00	1,222.00
570.3 · Insurance Other	166.00	0.00
Total 570.0 · Insurance	1,186.00	1,222.00
575.0 · Rent	18,624.00	18,624.00
580.0 · Bank Service Charges	740.88	0.00
581.0 · Equipment Rental		
581.3 · Postage meter	296.32	360.00
Total 581.0 · Equipment Rental	296.32	360.00
583.0 · Miscellaneous Expenses	0.00	0.00
591.0 · Licenses and Permits	120.00	245.00
Total Expense	200,000.00	200,000.00

Western States Seismic Policy Council
FEMA Grant 2007 Budget vs. Actual
August-November 2007

	Aug - Nov '07	Budget
Ordinary Income/Expense		
Income		
450.0 · Grants Earned		
460.0 · FEMA Grants Earned		
460.3 · 2007 FEMA Grants Earned	65,080.79	
Total 460.0 · FEMA Grants Earned	65,080.79	
Total 450.0 · Grants Earned	65,080.79	
Total Income	65,080.79	200,000.00
Expense		
500.0 · P/R Expenses		
500.1 · Salary	32,038.32	109,573.00
500.2 · Benefits		
500.7 · Employer IRA Contribution		
500.701 · Sutch IRA Employer Contribution	551.68	2,207.19
Total 500.7 · Employer IRA Contribution	551.68	
500.2 · Benefits - Other	1,718.30	
Total 500.2 · Benefits	2,269.98	7,361.43
500.3 · Employer Contrib/Taxes	2,678.53	10,139.36
500.4 · Workers' Comp	622.58	2,090.52
500.5 · Payroll Service	1,360.00	4,080.00
500.6 · Job Search	0.00	
Total 500.0 · P/R Expenses	38,969.41	138,352.71
506.0 · Prof Fees Accounting	860.00	10,700.00
509.0 · Prof Fees Other	300.00	5,125.00
510.0 · Office Supplies	586.17	1,274.00
515.0 · Telephone	528.00	1,600.00
522.0 · Postage and Delivery	32.79	875.00
525.0 · Internet Services	417.54	1,438.20
530.0 · Staff Expenses		
530.2 · Staff Mileage	140.17	297.00
530.3 · Staff Transportation	0.00	1,382.00
530.4 · Staff Hotel	0.00	3,123.00
530.6 · Staff Meetings	0.00	300.00
Total 530.0 · Staff Expenses	140.17	5,102.00
535.0 · Executive Committee Expense		
535.2 · Mileage Exec Comm	38.81	148.50
535.3 · Transportation Exec Comm	2,007.30	7,760.00

	Aug - Nov '07	Budget
535.4 · Hotel Exec Comm	2,441.60	7,064.00
535.0 · Executive Committee Expense- Other	41.97	0.00
Total 535.0 · Executive Committee Expense	4,529.68	14,972.50
553.0 · 2007 WSSPC-ICC Annual Conf Reno		
553.1 · AC 07 Transportation		
553.11 · Airfare	1,384.49	
553.12 · Ground Transportation	91.30	
553.13 · Mileage	141.14	
Total 553.1 · AC 07 Transportation	1,616.93	0.00
553.2 · AC 07 Contractors	1,922.25	
553.3 · AC 07 Hotel	2,596.68	
553.5 · AC 07 Meeting Costs	4,137.29	
553.7 · AC 07 Shipping	676.54	
Total 553.0 · 2007 WSSPC-ICC Annual Conf Reno	10,949.69	0.00
570.0 · Insurance		
570.1 · Liability Insurance		1,186.59
570.3 · Insurance Other		
Total 570.0 · Insurance	0.00	1,186.59
575.0 · Rent	6,208.00	18,624.00
580.0 · Bank Service Charges	1,492.05	336.00
581.0 · Equipment Rental		
581.3 · Postage meter	67.29	264.00
Total 581.0 · Equipment Rental	67.29	264.00
591.0 · Licenses and Permits	0.00	150.00
Total Expense	65,080.79	200,000.00

Western States Seismic Policy Council
USGS Grant 2007 Budget vs. Actual
Grant Period March 1, 2007 through November 30, 2007

	Mar - Nov 07	Budget
Ordinary Income/Expense		
Income		
450.0 · Grants Earned		
465.0 · USGS Grants Earned		
465.2 · 2007 USGS Grants Earned	10,000.00	10,000.00
Total 465.0 · USGS Grants Earned	10,000.00	10,000.00
Total 450.0 · Grants Earned	10,000.00	10,000.00
Total Income	10,000.00	10,000.00
Expense		
553.0 · 2007 WSSPC-ICC Annual Conf Reno		
553.1 · AC 07 Transportation	631.06	1,350.00
553.6 · AC 07 Printing	7,755.96	7,775.00
553.7 · AC 07 Shipping	1,612.98	875.00
Total 553.0 · 2007 WSSPC-ICC Annual Conf Reno	10,000.00	10,000.00
Total Expense	10,000.00	10,000.00

3. WSSPC Events

2007 WSSPC EVENTS

2007 National Earthquake Program Managers Meeting
April 24-26, 2007
Pigeon Forge, Tennessee

The National Earthquake Program Managers Meeting was held for the third consecutive year, this year at Pigeon Forge, Tennessee. State Earthquake Program Managers gathered to share program ideas, best practices, and collaborated to make their respective states safer. Highlights of the program included presentations on the Kiholo Bay, Hawaii earthquake; New Madrid Seismic Zone catastrophic planning; and public health medical planning and response capabilities of the Centers for Disease Control and Prevention. The meeting was hosted by the State of Tennessee and sponsored by the National Earthquake Hazards Reduction Program, FEMA, and the earthquake consortia: CREW, CUSEC, NESEC, and WSSPC.

2007 WSSPC Annual Conference
September 30 – October 3, 2007
Grand Sierra Resort
Reno, Nevada

The 2007 WSSPC Annual Conference was held jointly with the International Code Council in Reno, Nevada, September 30-October 3, 2007.

There were 123 registrants for the WSSPC conference. Of that total, 19 were ICC members who attended only the Sunday field trip. Three cancelled, leaving a total of 101 attendees at the full conference.

Eight people received complimentary registrations: 3 speakers, 2 Awards winners, 1 Affiliate member, and 2 ICC cross-participants.

WSSPC supported travel for members from 7 states: Representatives from Idaho EM, Oregon GS, Idaho GS, and Wyoming GS; and Board members from Montana, Utah, Alaska, Oregon, and Colorado.

Total Conference registration income was $34,840, and exhibitor income from ICC $2,400, which represents $800 credit for 3 exhibitors in the Seismic Safety Zone.

The USGS provided a grant for $10,000 which covered the field trip bus, printing, and shipping costs for the conference.

The 2 FEMA Cooperative Agreements covered $20,889.89 of the expenses. Included were staff and Board expenses, and bank service charges, shown separately from the annual conference category.

Bank expenses include the 5 and 6% charged on the credit cards, as well as monthly charges for maintaining the credit card capability. Of the total bank service charges for the year, 88% are attributable to the conference.

Contractors were Regonline (charging a $4.75 per person fee and 5-6% credit card fees), Ralph Clouse, Colleen Gonzales, and Sylvia Burgess.

Costs were less than expected due to the price break for volume with ICC: audio-visual, catering, and no worries about filling the hotel block or paying for wireless. In addition, transportation expenses for WSSPC representatives and speakers were promised and budgeted at a higher level than reimbursement requests were received and fulfilled.

In general, to break even we need 100 people paying registration fees of $350. Typically, it is difficult to lower expenses below the $40,000 threshold.

Joint WSSPC-ICC Seminar

Sixty-two participants from ICC attended the joint program, along with the 90 WSSPC attendees.

Most ICC participants were code officials, engineers, or "other".

Over half had more than 16 years experience and represented at least 18 states.

ICC participation and evaluations were assured due to offering CEUs. Registration was cut off at 65 due to room size limitations, although we had many more requests to include more people.

We could have had a complete seismic track throughout the whole conference, but CEUs were not offered, therefore, we did not get ICC participation in those sessions.

2007 Seismic Councils and Commissions Meeting at WSSPC Annual Conference
October 3, 2007
Reno, Nevada

The last afternoon of the 2007 WSSPC Annual Conference was devoted to a meeting of representatives from WSSPC member seismic councils and commissions and other states interested in forming commissions. The goal of the meeting was to improve working relationships among the western states' seismic councils and commissions. Improving communication and increasing awareness of products, policies and legislation were commonly mentioned themes. As a result of the discussion, the WSSPC office and the California Seismic Safety Commission (CSSC) offered to create a web-based communications prototype to be available for review at the next seismic commissions and councils meeting at the 2008 National Earthquake Conference. Pending approval of the CSSC, the WSSPC Forum will be linked from the CSSC website.

4. WSSPC Awards

2007 Western States Seismic Policy Council
Award Winners

Awards were presented at the WSSPC-ICC Annual Conference
Awards in Excellence Luncheon
Tuesday October 2, 2007

2007 WSSPC Lifetime Achievement Award

Lifetime Achievement Award in Earthquake Risk Reduction
Richard K. Eisner

2007 WSSPC Awards in Excellence Winners

Overall Award in Excellence

Mitigation
Hawaii State Civil Defense, Hawaii State Earthquake Advisory Committee, and Hawaii Coastal Zone Management Program
Earthquake Hazards and Estimated Losses in the County of Hawaii

Awards in Excellence

Outreach to Business/Government, Schools, and General Public
Lincoln County School District
Earthquake/Tsunami Preparedness Program

Research Efforts
Utah Geological Survey/WSSPC Basin & Range Province Committee
Basin & Range Province Earthquake Working Group

Innovations (Public-Private Partnerships)
Oregon Natural Hazards Workgroup at the University of Oregon
Partners for Disaster Resistance & Resilience

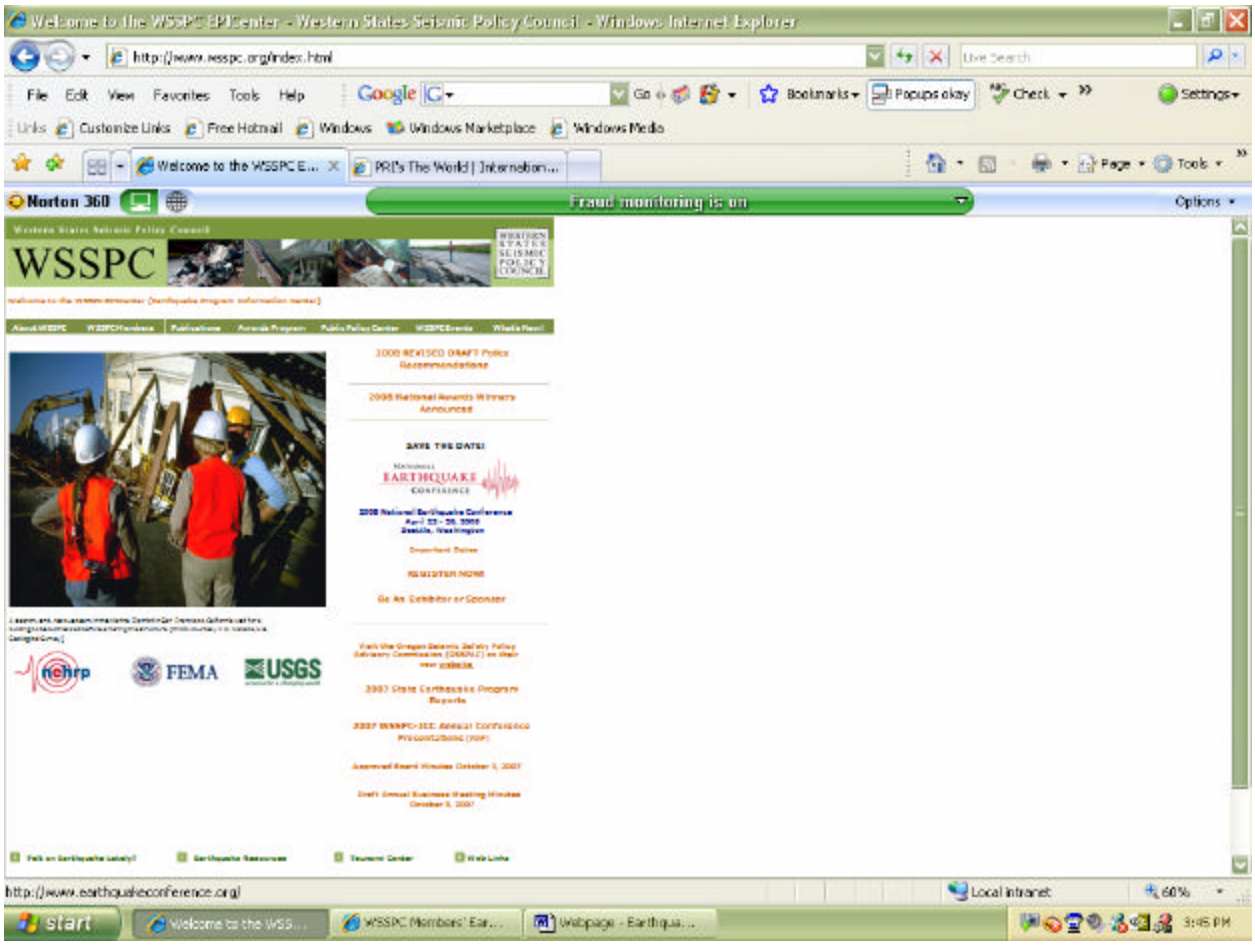
Non-Profit Agency Efforts
Pacific Tsunami Museum
Walking & Driving Tours of Historical Tsunami Sites

5. Website: Earthquake Resources

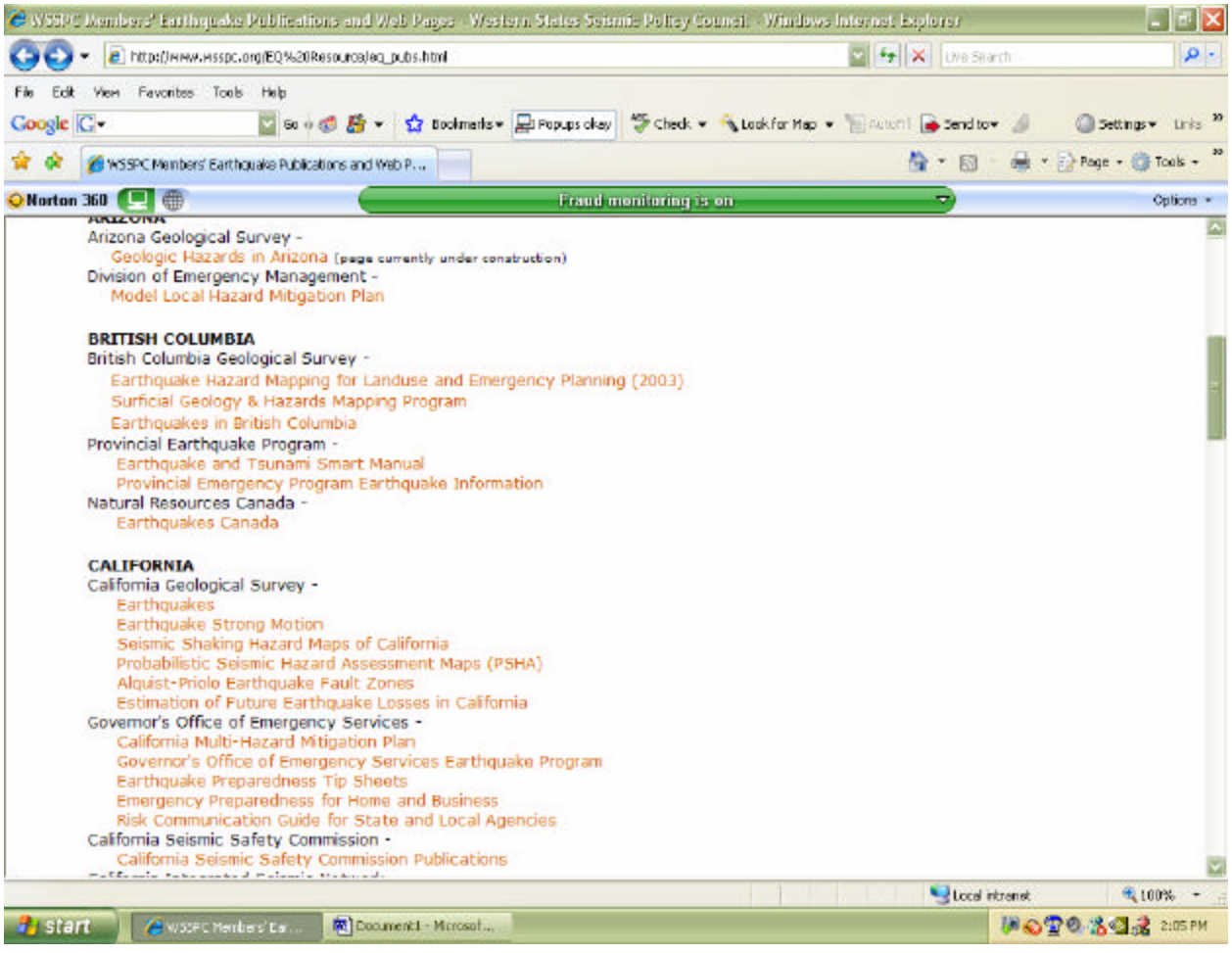
Earthquake Resources Webpage

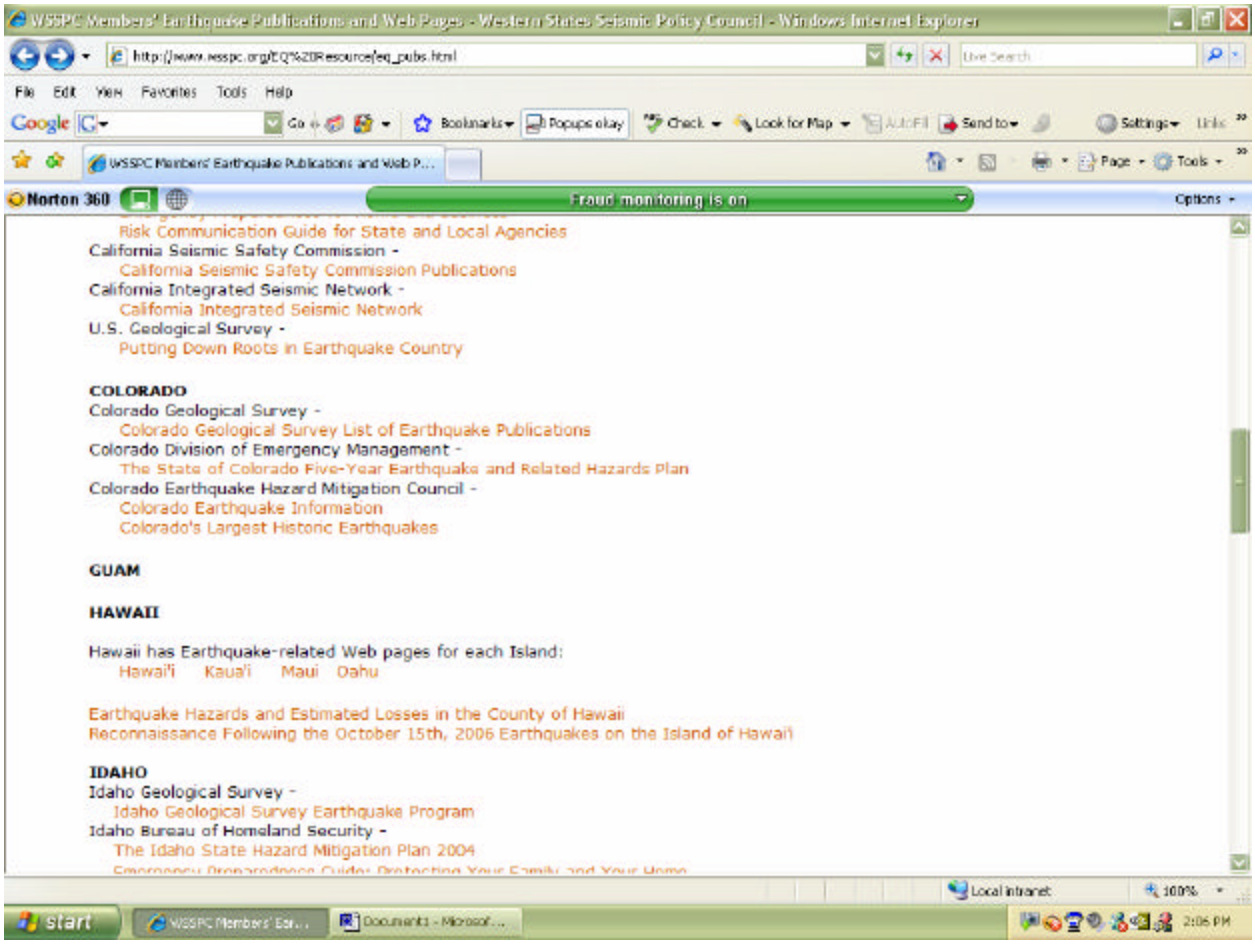
www.wsspc.org

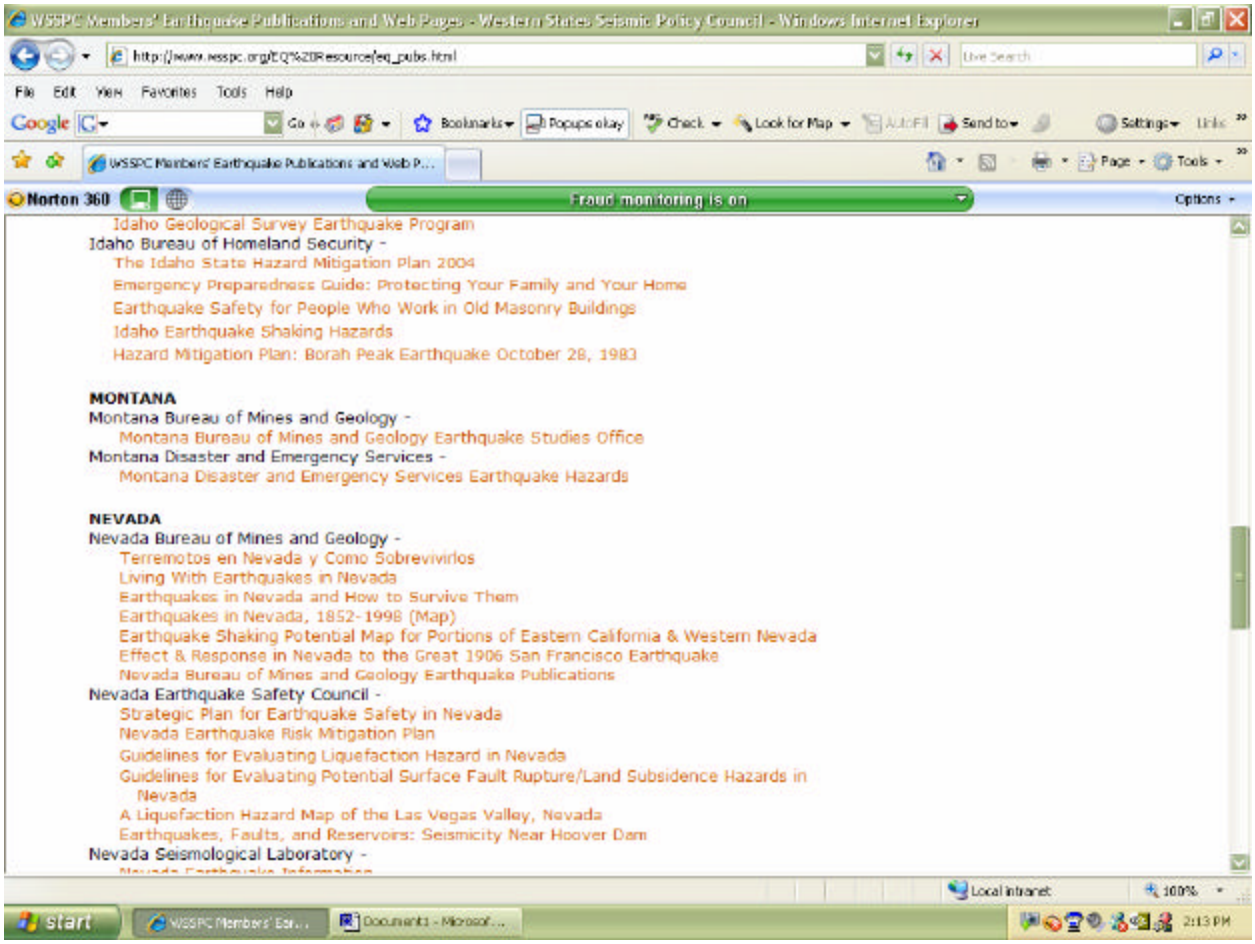
In 2007 the Earthquake Resources webpage on the WSSPC website was created to link to member earthquake-related publications and web pages. The webpage is linked from the bottom of the WSSPC home page by clicking on “Earthquake Resources”. The screen shots on this and following pages illustrate the path to the Earthquake Resources page, as well as the page itself.




WSSPC Members' Earthquake Publications and Web Pages - Western States Seismic Policy Council - Windows Internet Explorer
Western States Seismic Policy Council
WSSPC
WESTERN STATES SEISMIC POLICY COUNCIL
Home > WSSPC Members' Earthquake Publications and Web Pages
> Contact Us
About WSSPC | WSSPC Members | Publications | Awards Program | Public Policy Center | WSSPC Events | What's New!
WSSPC Members' Earthquake Resources
ALASKA
Division of Geological and Geophysical Surveys -
Guide to Geologic Hazards in Alaska - Introduction
Earthquake Publications
Denali Fault Earthquake Information
Alyeska Pipeline Earthquake Protection
Division of Homeland Security and Emergency Management -
DHS&EM Earthquake Program
2004 Alaska State All Hazard Mitigation Plan
Seismic Hazards Safety Commission -
An Insurance Perspective on Earthquake Events in Alaska
AMERICAN SAMOA
ARIZONA
Arizona Geological Survey -
Geologic Hazards in Arizona (page currently under construction)
Division of Emergency Management -


WSSPC Members' Earthquake Publications and Web Pages - Western States Seismic Policy Council - Windows Internet Explorer
Arizona Geological Survey -
Geologic Hazards in Arizona (page currently under construction)
Division of Emergency Management -
Model Local Hazard Mitigation Plan
BRITISH COLUMBIA
British Columbia Geological Survey -
Earthquake Hazard Mapping for Landuse and Emergency Planning (2003)
Surficial Geology & Hazards Mapping Program
Earthquakes in British Columbia
Provincial Earthquake Program -
Earthquake and Tsunami Smart Manual
Provincial Emergency Program Earthquake Information
Natural Resources Canada -
Earthquakes Canada
CALIFORNIA
California Geological Survey -
Earthquakes
Earthquake Strong Motion
Seismic Shaking Hazard Maps of California
Probabilistic Seismic Hazard Assessment Maps (PSHA)
Alquist-Priolo Earthquake Fault Zones
Estimation of Future Earthquake Losses in California
Governor's Office of Emergency Services -
California Multi-Hazard Mitigation Plan
Governor's Office of Emergency Services Earthquake Program
Earthquake Preparedness Tip Sheets
Emergency Preparedness for Home and Business
Risk Communication Guide for State and Local Agencies
California Seismic Safety Commission -
California Seismic Safety Commission Publications


WSSPC Members' Earthquake Publications and Web Pages - Western States Seismic Policy Council - Windows Internet Explorer
http://www.wsspc.org/Q%20Resource/eq_pubs.html
Fraud monitoring is on
Risk Communication Guide for State and Local Agencies
California Seismic Safety Commission -
California Seismic Safety Commission Publications
California Integrated Seismic Network -
California Integrated Seismic Network
U.S. Geological Survey -
Putting Down Roots in Earthquake Country
COLORADO
Colorado Geological Survey -
Colorado Geological Survey List of Earthquake Publications
Colorado Division of Emergency Management -
The State of Colorado Five-Year Earthquake and Related Hazards Plan
Colorado Earthquake Hazard Mitigation Council -
Colorado Earthquake Information
Colorado's Largest Historic Earthquakes
GUAM
HAWAII
Hawaii has Earthquake-related Web pages for each Island:
Hawai'i Kaua'i Maui Oahu
Earthquake Hazards and Estimated Losses in the County of Hawaii
Reconnaissance Following the October 15th, 2006 Earthquakes on the Island of Hawai'i
IDAHO
Idaho Geological Survey -
Idaho Geological Survey Earthquake Program
Idaho Bureau of Homeland Security -
The Idaho State Hazard Mitigation Plan 2004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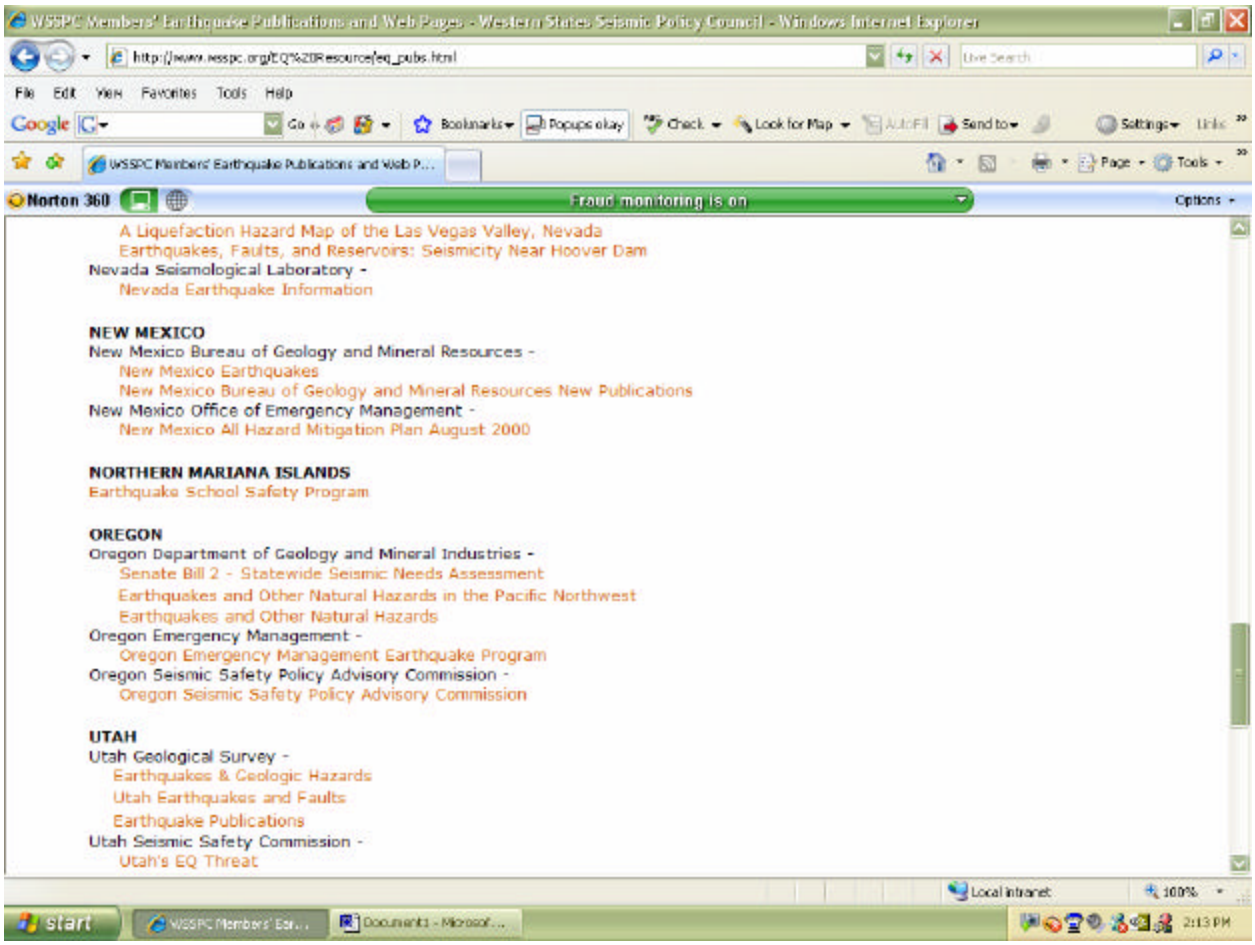
http://www.wsspc.org/Q%20Resource/eq_pubs.html
Fraud monitoring is on
Idaho Geological Survey Earthquake Program
Idaho Bureau of Homeland Security -
The Idaho State Hazard Mitigation Plan 2004
Emergency Preparedness Guide: Protecting Your Family and Your Home
Earthquake Safety for People Who Work in Old Masonry Buildings
Idaho Earthquake Shaking Hazards
Hazard Mitigation Plan: Borah Peak Earthquake October 28, 1983
MONTANA
Montana Bureau of Mines and Geology -
Montana Bureau of Mines and Geology Earthquake Studies Office
Montana Disaster and Emergency Services -
Montana Disaster and Emergency Services Earthquake Hazards
NEVADA
Nevada Bureau of Mines and Geology -
Terremotos en Nevada y Como Sobrevivirlos
Living With Earthquakes in Nevada
Earthquakes in Nevada and How to Survive Them
Earthquakes in Nevada, 1852-1998 (Map)
Earthquake Shaking Potential Map for Portions of Eastern California & Western Nevada
Effect & Response in Nevada to the Great 1906 San Francisco Earthquake
Nevada Bureau of Mines and Geology Earthquake Publications
Nevada Earthquake Safety Council -
Strategic Plan for Earthquake Safety in Nevada
Nevada Earthquake Risk Mitigation Plan
Guidelines for Evaluating Liquefaction Hazard in Nevada
Guidelines for Evaluating Potential Surface Fault Rupture/Land Subsidence Hazards in Nevada
A Liquefaction Hazard Map of the Las Vegas Valley, Nevada
Earthquakes, Faults, and Reservoirs: Seismicity Near Hoover Dam
Nevada Seismological Laboratory -


WSSPC Members' Earthquake Publications and Web Pages - Western States Seismic Policy Council - Windows Internet Explorer
http://www.wsspc.org/EQ%20Resource/eq_pubs.html
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Options
A Liquefaction Hazard Map of the Las Vegas Valley, Nevada
Earthquakes, Faults, and Reservoirs: Seismicity Near Hoover Dam
Nevada Seismological Laboratory -
Nevada Earthquake Information
NEW MEXICO
New Mexico Bureau of Geology and Mineral Resources -
New Mexico Earthquakes
New Mexico Bureau of Geology and Mineral Resources New Publications
New Mexico Office of Emergency Management -
New Mexico All Hazard Mitigation Plan August 2000
NORTHERN MARIANA ISLANDS
Earthquake School Safety Program
OREGON
Oregon Department of Geology and Mineral Industries -
Senate Bill 2 - Statewide Seismic Needs Assessment
Earthquakes and Other Natural Hazards in the Pacific Northwest
Earthquakes and Other Natural Hazards
Oregon Emergency Management -
Oregon Emergency Management Earthquake Program
Oregon Seismic Safety Policy Advisory Commission -
Oregon Seismic Safety Policy Advisory Commission
UTAH
Utah Geological Survey -
Earthquakes & Geologic Hazards
Utah Earthquakes and Faults
Earthquake Publications
Utah Seismic Safety Commission -
Utah's EQ Threat
Local intranet
100%
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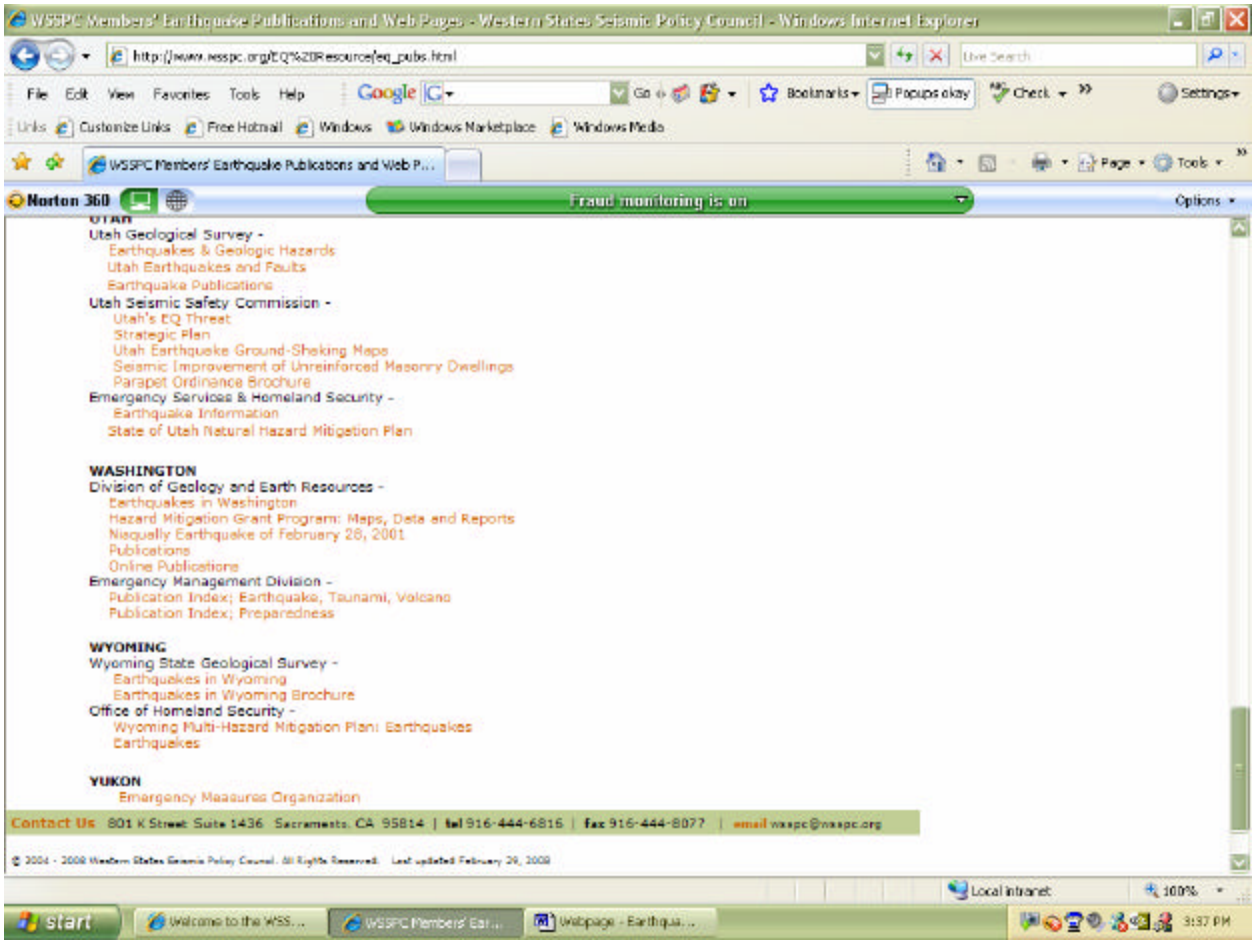
WSSPC Members' Earthquake Publications and Web Pages - Western States Seismic Policy Council - Windows Internet Explorer
http://www.wsspc.org/EQ%20Resource/eq_pubs.html
Norton 360
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Options
Utah Geological Survey -
Earthquakes & Geologic Hazards
Utah Earthquakes and Faults
Earthquake Publications
Utah Seismic Safety Commission -
Utah's EQ Threat
Strategic Plan
Utah Earthquake Ground-Shaking Maps
Seismic Improvement of Unreinforced Masonry Dwellings
Parapet Ordinance Brochure
Emergency Services & Homeland Security -
Earthquake Information
State of Utah Natural Hazard Mitigation Plan
WASHINGTON
Division of Geology and Earth Resources -
Earthquakes in Washington
Hazard Mitigation Grant Program: Maps, Data and Reports
Nisqually Earthquake of February 28, 2001
Publications
Online Publications
Emergency Management Division -
Publication Index; Earthquake, Tsunami, Volcano
Publication Index; Preparedness
WYOMING
Wyoming State Geological Survey -
Earthquakes in Wyoming
Earthquakes in Wyoming Brochure
Office of Homeland Security -
Wyoming Multi-Hazard Mitigation Plan: Earthquakes
Earthquakes
YUKON
Emergency Measures Organization
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6. Currently Adopted Policy Recommendations

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATIONS 07-1 and 07-2

Rapid Tsunami Identification and Evacuation Notification

Policy Recommendation 07-1

Promote the development of tsunami evacuation and re-entry notification systems, supplemented with an education campaign, that insure 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.

Policy Recommendation 07-2

WSSPC recommends the implementation of modern technological systems that rapidly identify the tsunami potential generated from a local earthquake and that immediately alert locally responsible emergency operations personnel about coastal areas likely to be affected by a tsunami. Information provided by these systems would augment any area evacuation decisions based on ground shaking.

Background

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

Where nearby coastlines are affected, the public is instructed to move away from the shoreline and to high ground whenever strong 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 tourists are found in a variety of geographical locations and structures along the shoreline. Therefore, the use of redundant warning systems (such as radio broadcasts and outdoor sirens on beaches) would increase the immediacy and the coverage of the evacuation notification. 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.

In some instances, ground shaking may be a precursor, and an “early warning”, to the hazard of a tsunami. Coastal communities that are known to be vulnerable to the hazards of a tsunami should be prepared to evacuate for higher ground when ground shaking is experienced. Because few earthquakes cause tsunamis, a tsunami warning system should also be able to determine if evacuation activities are necessary as quickly as possible. Unnecessary evacuations are costly not only in terms of 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 emergency operations personnel; and, 3) direct notification to the coastal inhabitants, through the use of broadcast media, to initiate emergency response plans.

Facilitation and Communication

1. Encourage representatives from state agencies and state lobbyists to use Policy Recommendation 07-1 in efforts with their legislative delegations to develop rapid, multiple tsunami education and notification systems in their respective states, territories and provinces. This includes promoting tsunami task forces or similar groups, soliciting local government support, and requesting funds. In addition, education and evacuation planning are critical components of overall tsunami risk reduction and, therefore, should be promoted along with tsunami notification systems.

2. Forward Policy Recommendation 07-2 to the National Oceanic and Atmospheric Administration (NOAA), National Aeronautics and Space Administration, United States Geological Survey, and other organizations as appropriate, for their budget and technical support.

Assessment

The assessment of these policies can be measured by: 1) the adoption of tsunami hazard policies at state, territorial and provincial, as well as local governments on tsunami warning dissemination and evacuation; 2) comprehensiveness of notification systems adopted by state, territorial, provincial and local jurisdictions; 3) Public Law 109-424 that requires improvement in tsunami detection, forecasting, warning, notification, outreach, and mitigation in tsunami communities; 4) communities being designated by NOAA/National Weather Service as a TsunamiReady™ Community; and 5) number of public education workshops and surveys completed in at-risk tsunami communities.

History

Policy Recommendations 07-1 and 07-2 were first adopted as Policy Recommendations 01-1 and 01-2. PR 01-1 was revised and adopted as PR 04-1 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. PR 01-2 was re-adopted as PR 04-2 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. The Assessment section was revised and Policy Recommendations 04-1 and 04-2 were readopted as PR 07-1 and PR 07-2 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 07-3

Post-Earthquake Technical Clearinghouses

Policy Recommendation 07-3

WSSPC recommends that each member state, province, and territory establish a plan for a post-earthquake technical clearinghouse to be activated within 24 hours after each major earthquake within its jurisdiction.

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 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); and Nisqually, Washington (2001) 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.

Facilitation and Communication

WSSPC recommends that its members establish a plan for a post-earthquake technical clearinghouse to be activated within 24 hours after a major earthquake within its jurisdiction. WSSPC further encourages its members to form MOAs to facilitate the operation of clearinghouses, including sending employees from one jurisdiction to another to assist in collection of field data and in staffing a clearinghouse. WSSPC will construct a roster of experts who are willing to participate and disseminate information on clearinghouses that are established after an earthquake.

The NEHRP agencies' post-earthquake investigations plan specifies coordination with states to operate clearinghouses. WSSPC members should develop MOAs with NEHRP agencies to facilitate clearinghouse staffing and operations, and to specify whether a member wishes the NEHRP agencies to take responsibility for establishing a clearinghouse. These MOAs could include triggers, such as USGS or EERI deployment only if moment magnitude exceeds certain values for an urban epicenter or for a rural earthquake. WSSPC members may wish to activate clearinghouses at lower triggers for purposes of training or when sufficient resources exist to respond to the earthquake. Any MOA should recognize the considerable role and interest of FEMA in post-earthquake technical clearinghouses.

To achieve the above goals, WSSPC will establish a Post-Earthquake Technical Clearinghouse Committee (PTCC) to update the WSSPC model post-earthquake technical clearinghouse plan, and to develop model MOAs for use among members and between members and NEHRP agencies for post-earthquake technical clearinghouse operation and assistance. PTCC should conduct workshops and use other means to help members establish individual post-earthquake technical clearinghouse plans and implement clearinghouse MOAs.

WSSPC recommends that the USGS provide mirrored or parallel access to its post-earthquake website. One ultra-high volume portal should be available to the general public. A second, password-protected site should be maintained. State emergency management agencies, state geological surveys, state seismic safety commissions and councils, earthquake consortia, university seismological laboratories and engineering-research centers, and the press should have access to the password-protected site.

WSSPC recommends that emergency response and recovery plans incorporate and refer to post-earthquake technical clearinghouse plans. There should be links between the technical clearinghouse and emergency management operations. Because the clearinghouse can provide vital information during emergency response and recovery, FEMA should work with emergency managers to assure that appropriate federal funding and FEMA staff support are provided for the clearinghouse, whenever a clearinghouse is established following an earthquake.

Once members have established post-earthquake technical clearinghouse plans, WSSPC recommends that they hold regular training sessions and exercises to ensure readiness and compatibility with other emergency response functions. WSSPC also recommends that those responsible for mobilizing post-earthquake clearinghouses participate in large-scale earthquake

exercises sponsored by states or local jurisdictions to test procedures that link research activities with emergency operations centers.

Funding will be required to pay travel to update WSSPC's model post-earthquake technical clearinghouse plan, prepare model MOAs, and hold workshops. WSSPC and the PTCC should take the lead in developing a proposal to acquire the necessary funding if work cannot be performed at WSSPC annual meetings and by electronic means.

Assessment

Measures of the success of this Policy Recommendation will be (1) the number of additional WSSPC members that develop post-earthquake technical clearinghouse plans, and (2) the number of MOAs established to facilitate clearinghouse operation. A periodic assessment should be made to determine the number of functioning clearinghouse plans and supporting MOAs. WSSPC will periodically update its model post-earthquake technical clearinghouse plan, and will post this and individual member plans on the WSSPC website.

History

Policy Recommendation 07-3 was first adopted as Policy Recommendation 01-3 by unanimous vote of the WSSPC membership at the Annual Business meeting October 24, 2001. PR 01-3 was revised and re-adopted as PR 04-3 by unanimous vote of the WSSPC membership at the Annual Business meeting September 30, 2004. The Background section was revised and PR 04-3 was readopted as PR 07-3 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 07-4

Seismic Provisions in the International Building Code

Policy Recommendation 07-4

WSSPC endorses the prompt adoption and enforcement by states, territories, provinces and/or local jurisdictions of the seismic provisions of the *International Existing Building Code*, the *International Building Code*, and the *International Residential Code*. 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 to include National Earthquake Hazards Reduction Program (NEHRP) provisions with a specific focus on purpose, education, incentives, lifelines and the business/industry and homeowner sectors.

Background

Policy Session Number 5 (Earthquake Building Codes in the 21st Century) of the National Earthquake Risk Management Conference in Seattle, Washington (September 2000) generated considerable discussion and resulted in a number of recorded points from the audience. A process to compile the comments into grouping and distilling actions resulted in a potential arena for a WSSPC Policy Statement relative to "codes". A consensus at the Conference from the presenters and the structured audience participation concluded that adoption by local jurisdictions of the 2000 *International Building Code* and the *International Residential Code* should be the first order of business. 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 adoptions, 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 in 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, etc., with focused concerns on lifelines and public safety will be required to overcome the inertia of commitment to meet the desired outcomes.

Facilitation and Communication

Incentive measures will need to be developed that involve federal, state, territorial, provincial and local funding to "encourage" adoption of building codes that recognize local natural hazards caused by earthquakes. Education of the public on the need and purpose for codes must work towards a mindset to mitigate damage from earthquakes before they happen. Local building code inspectors will require training and certification in the new codes.

Assessment

A measure of the acceptance of this policy recommendation is the number of states, provinces, territories and local jurisdictions that have adopted seismic provisions that meet or exceed the seismic provisions in the *International Building Code, International Residential Code* and *International Existing Building Code*.

History

Policy Recommendation 07-4 was first adopted as Policy Recommendation 01-4. PR 01-4 was revised and redesigned as PR 04-4 and re-adopted by unanimous vote of the WSSPC membership at the Annual Business Meeting September 30, 2004. The Policy Recommendation statement was revised and PR 04-4 was readopted as PR 07-4 by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 07-5

Basin and Range Province Earthquake Working Group(s)

Policy Recommendation 07-5

WSSPC recommends convening a technical Basin and Range Province Earthquake Working Group(s) (BRPEWG) to meet with experts from Basin and Range Province (BRP) states to arrive at consensus average recurrence intervals (RI) and slip rates (SR) and other seismic hazard parameters with related uncertainties for active faults. Best available RI and SR values with appropriate uncertainties are critical to U.S. Geological Survey (USGS) seismic-hazard evaluations and for determining which faults should be included on the National Seismic Hazard Maps (NSHMs). The BRPEWG(s) should be convened under the auspices of the USGS NSHM project.

Background

With release of the Quaternary fault and fold database of the U.S. by the USGS, based in part on completion of databases by states, the need arises to look critically at existing paleoseismic-trench data, and where the data permit, develop consensus regarding appropriate average RI and SR values and related uncertainties for faults in each state.

Only two BRP states (California and Utah) have completed comprehensive reviews of their paleoseismic trenching data to determine consensus RI and SR values, and the process is currently underway in a third state (Nevada). In most instances, currently available RI and SR values are the result of individual studies performed over a period of decades by a variety of investigators with varying levels of experience and resources. Older studies lack the advantage of recent advances in paleoseismic techniques, particularly refinements in sampling strategies and dating technologies. Consequently, available RI and SR values are not all of equal reliability, and often uncertainties associated with those data are either poorly defined or not reported.

Achieving consensus on complex technical issues requires a process of inquiry, discussion, and agreement. Technical working groups have successfully reached consensus in many instances, including the Working Groups on California Earthquake Probabilities, the Utah Quaternary Fault Parameters Working Group, and various Utah geologic-hazards-mapping working groups. A previously convened BRPEWG successfully brought together scientists to identify issues, discuss evidence, and define strategies for resolving issues regarding fault behavior in the BRP important to the next update of the NSHMs.

Facilitation and Communication

WSSPC recommends that individual BRP states identify the faults for which sufficient paleoseismic trenching data are available to develop average RI and SR values and related uncertainties. The national Quaternary fault and fold database and state Quaternary fault databases form the basis for identifying these faults. Once identified, the BRPEWG(s) can meet with appropriate state experts to arrive at consensus RI and SR values as has already been done in California and Utah. Where consensus can be achieved, the BRPEWG can make recommendations for the USGS to consider in future updates of the NSHMs. Where consensus is not yet possible, an interim recommendation can be made for consideration in the NSHMs, and a research program outlined to resolve the issues so that consensus can ultimately be reached. Thus, a principal product of the process will be a list of priorities for future studies needed to achieve

consensus that can provide support for the USGS in setting priorities both for internal studies and for the National Earthquake Hazard Reduction Program (NEHRP) External Grants program.

Funding will be required to pay travel and some salary expenses to hold workshops and to prepare reports. The WSSPC Basin and Range Committee, BRP state geological surveys, or other organizing entity should take the lead in developing a proposal to acquire funding. The BRPEWG(s) will serve only for the time it takes to complete their work, and then will be disbanded until additional information becomes available for consideration.

Given the importance of RI and SR data to the NSHMs, the completion of such reviews is critical in all WSSPC BRP states. WSSPC should work with the USGS to encourage such work by giving it a priority in the annual NEHRP Request for Proposals to help provide necessary funding. Other potential funding sources include the Federal Emergency Management Agency and internal funding from individual BRP states.

Assessment

The success of this Policy Recommendation can be assessed based on: (1) the number of states that empanel a BRPEWG to develop consensus RI and SR values, (2) the use of the resulting consensus RI and SR values by the USGS in future updates of the NSHMs, and by states and local governments in regulations and ordinances, and (3) the presentation of BRPEWG results to state emergency managers to ensure that the results reach the general public in a timely manner. A periodic assessment should be made to determine the extent to which the consensus RI and SR values are being incorporated into the NSHMs; individual probabilistic seismic hazard analyses; and state and local seismic-hazard rules, regulations, and guidelines.

History

Policy Recommendation 07-5 was first adopted as Policy Recommendations 04-5 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 30, 2004. The Policy Recommendation statement was revised and PR 04-5 was readopted by unanimous vote of the WSSPC membership at the Annual Business Meeting October 3, 2007.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 07-6

Post-Earthquake Information Management System

Policy Recommendation 07-6

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 systems to assemble and archive data from other natural hazards events.

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 07-3) 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."

Facilitation and Communication

Adequate funding is necessary to establish this data collection guidance, and WSSPC supports use of federal funding, through NEHRP and/or the Stafford Act to support these activities for significant events. Earthquake clearinghouses may be established through specific mission assignments under the Stafford Act or through individual state authorizations.

WSSPC supports the development of a pilot or demonstration Post-Earthquake Information

Management System project as soon as possible. This pilot could use data previously collected from a recent disaster, and would serve as a model to facilitate the implementation of a more general Management System following the next earthquake disaster.

WSSPC members are encouraged to develop public and private partnerships and Memoranda of Understanding with owners and regulators for the purpose of assuring that earthquake performance and damage information would be collected and made available for future use. These partnerships would identify critical data gaps and work to develop data collection strategies to fill those gaps in the aftermath of a significant event. These memoranda will need to address such issues as the need for inventory information, restrictions on facility access, security of confidential or sensitive data, etc.

WSSPC encourages its members to support operation of a standardized national Post-Earthquake Information Management System. Members are encouraged to coordinate their data post-earthquake collection and clearing house activities with the national Management System, and provide collected data and information to the post-earthquake data archive that is a component of the Management System. A key element in the Management System is standards for the specification of the types and formats of information necessary to be collected to ensure a thorough and accurate documentation of performance of the built environment during the earthquake.

Assessment

Measures of the success of this policy will be (1) the annual communication of WSSPC members' support to NEHRP (and to other federal agencies as appropriate) for the establishment of a national Post-Earthquake Information Management System, (2) written support for the establishment of a pilot or demonstration Post-Earthquake Information Management System as developed by the American Lifelines Alliance or some other entity, and (3) preparation of an annual summary of WSSPC members' state-level progress in establishing in their jurisdictions one or more local or regional partnerships and agreements for the purpose of assuring the collection of post-earthquake performance and damage information for long-term use. This assessment procedure assumes that the success of the policy may take many years to accomplish.

History

Policy Recommendation 07-6 was first proposed for adoption by the WSSPC membership at the Annual Business Meeting October 3, 2007, where it was unanimously approved as amended.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 06-1

Developing Earthquake Risk-Reduction Strategies

Policy Recommendation 06-1

WSSPC strongly encourages the development of 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.

WSSPC believes comprehensive statewide and local plans and strategies should include the following elements:

- Assessment of all seismic hazards to quantify and define the risk to communities;
- 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 [ongoing] public-education efforts and public/private partnerships to raise awareness of seismically induced threats and build constituent support for earthquake hazard reduction programs.

Background

WSSPC has long supported reduction of losses from seismic events through policy recommendations and annual conferences. One of the WSSPC Policy Recommendations (PR04-4) states that WSSPC supports the adoption and enforcement of the International Building and Residential Codes to reduce vulnerability to earthquakes. Given the high seismic activity in the western United States, Pacific territories, and Canada, mitigation of earthquake hazards is a common interest among all the western states, territories, and provinces. FEMA's Report 366, "HAZUS 99 Estimated Annualized Earthquake Losses for the United States", clearly shows that the western states are most at risk, with 88% 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. WSSPC should mentor parties who are responsible for public safety about the necessity and benefits of earthquake risk-mitigation policies and activities. WSSPC should promote the development of educational materials on mitigation for the general public.

WSSPC encourages private and public organizations to form 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. WSSPC is partnering with various organizations to promote these processes.

The Seismic Safety Boards and Commissions of the various states are important WSSPC partners. Each member state, territory and province has other affiliations with potential partners, such as the Oregon Natural Hazards Workgroup (ONHW), the Partners for Disaster Resistance & Resilience: Oregon Showcase State Program, and the Cascadia Region Earthquake Workgroup (CREW).

WSSPC should encourage its partners to seek potential outreach activities, mitigation plan development, or construction projects that can be submitted for funding through FEMA's various mitigation program grants. These efforts complement FEMA's Pre-Disaster Mitigation initiatives.

Facilitation and Communication

This policy recommendation will be sent to all identified policy and decision makers (elected officials, heads of key departments, such as emergency managers, building officials and planners and chairs of the State Seismic Safety Commissions and Boards) as well as to WSSPC representatives in the member states. Policymakers' decision to support earthquake risk mitigation and foster partnerships is the key to effective mitigation in their state.

Assessment

Successes in policy implementation are occasions when mitigation actions or requirements are incorporated into public policies and decisions, and subsequently integrated into important public or private projects.

This statement of earthquake risk-reduction strategies should be adopted by all WSSPC partners. Successes should be submitted in a timely manner to WSSPC for posting on its website.

History

First adopted in 2003 as WSSPC Policy Recommendation 03-1. Reviewed, revised, and re-adopted as WSSPC Policy Recommendation 06-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting April 17, 2006.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 05-1

Improving Tsunami Warning, Preparedness, and Mitigation Procedures for Distant and Local Sources

Policy Recommendation 05-1

Tsunami Outreach

WSSPC supports the preeminent need to reduce loss of life from tsunamis through concentrated public education. Public education components must be institutionalized and consist of continuous instructional programs reinforced by exercises and training and subsequently measured using social science surveys to determine programmatic effectiveness. Buoys, sirens, and loudspeakers, etc., are meaningless if the general public does not know what to do in the immediate aftermath of an earthquake resulting in the potential for a tsunami.

Distant Tsunamis

WSSPC supports the efforts of the U.S. Geological Survey (USGS) and National Oceanic and Atmospheric Administration (NOAA) to continue deployment, maintenance, and improvement of the nation's seismic monitoring system and deep-ocean tsunami detection system for the purposes of rapidly and accurately detecting distant tsunamis and reducing warnings and watches leading to unnecessary evacuations. WSSPC further supports NOAA's effort to develop tsunami forecasting tools for coastal communities.

Local Tsunamis

WSSPC supports expanding the ongoing efforts of NOAA, USGS, and coastal members of WSSPC through the National Tsunami Hazard Mitigation Program (NTHMP) in mapping the tsunami inundation zone, developing tsunami evacuation maps, conducting research aimed at developing rapid warnings, and maintaining a continuous public education program about local tsunamis and the need to evacuate immediately after strong or sustained ground shaking stops.

Background

Tsunamis can be the most destructive aspect of an earthquake, not only to the nearby coastal areas but also to those areas distant from the source. 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 and Alaska Tsunami Warning Centers were established as a result of these destructive tsunamis and the need to warn coastal populations of tsunamis from distant sources.

Alarms triggered by nondestructive tsunamis have always been a major problem associated with warnings. Unnecessary evacuations not only create financial burdens on communities along the coast, but may also cause people to ignore the real threat if too many false warnings are given. Additionally, unnecessary evacuations may be risky to public safety. Programs to reduce unnecessary evacuations have been developed and implemented through the NTHMP. These programs will insure that the messages from the tsunami centers are more accurate and timely and that they significantly reduce the number of unnecessary evacuations along the coast.

However, Pacific Rim States must plan for local coastal earthquakes that will allow little to no time to issue a warning of a destructive tsunami. Subduction zone earthquakes, like the December 2004 Sumatra earthquake and tsunami, can cause the largest loss of life in tsunami at-risk coastal communities. Therefore, it is vitally important to educate the coastal residents, businesses, and visitors about the importance of immediate evacuation to high ground once the ground shaking stops.

In areas where no high ground is nearby, vertical evacuation in approved man-made structures may be the only option to escape the tsunami. Through the use of scientifically researched and developed tsunami inundation models and maps, community evacuation maps are developed showing evacuation routing and safe zones.

Facilitation and Communication

The WSSPC Board will write letters to NOAA, USGS, and FEMA requesting continued support for increased deployment of deep-ocean tsunami detection systems, the development of a tsunami forecasting model, ongoing maintenance and improvement of seismic monitoring for tsunamigenic earthquakes, and long-term risk reduction efforts.

WSSPC will write letters to key congressional representatives encouraging them to support S.B. 50 and House Bill 1674 that will lead to passing the Tsunami Preparedness Act, and to support expansion of the NTHMP in areas of highest risk. This Act will authorize and strengthen NTHMP's tsunami detection, forecast, warning, and mitigation programs.

Assessment

The effectiveness of the support letters would be measured by the continued financial support of the seismic monitoring system, the open ocean tsunami detection system, inundation mapping and mitigation by the NTHMP, and the adoption of the Tsunami Preparedness Act.

In turn, the effectiveness of the seismic monitoring and tsunami detection systems would be measured by the progress made in reducing the frequency of unnecessary evacuations at specific locations by modeling the threat under various scenarios to determine when warnings need to be issued. The effectiveness would also be measured by the successful and timely identification of a destructive tsunami from a distant source.

The effectiveness of the maps and educational campaigns would be measured in the short term by public awareness polling funded through the National Tsunami Hazard Mitigation Program, and in the long term by the minimal loss of life from a local tsunami, because people responded appropriately by quickly moving to higher and safer ground.

History

First adopted in 1999 as WSSPC Policy Recommendation 99-1. Reviewed, revised and re-adopted as WSSPC Policy Recommendation 02-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 18, 2002. Reviewed, revised and re-adopted as WSSPC Policy Recommendation 05-1 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 14, 2005.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 05-2

Active Fault Definition for the Basin and Range Province

Policy Recommendation 05-2

WSSPC recommends that the following definitions be used to categorize active faults in the Basin and Range physiographic province:

Holocene active fault – a fault that has moved in the past 10,000 years.

Late Quaternary active fault – a fault that has moved in the past 130,000 years.

Quaternary active fault – a fault that has moved in the past 1,800,000 years.

It should be emphasized that some historical magnitude 6.5 or greater earthquakes in the Basin and Range Province have occurred on faults that have not been active in the past 10,000 years; furthermore, earthquakes in the Province may occur on faults in all three categories.

It is the prerogative of the user to decide what level of earthquake hazard (surface fault rupture and ground shaking) is acceptable.

Background

Future earthquakes in the Basin and Range Province most likely will occur along faults that have had prior Quaternary activity. When the last major earthquake occurred along a fault and the time interval between the most recent earthquake and earlier earthquakes are factors that influence the probability of a similar earthquake within a given period of time. For example, a fault that has a major earthquake every 50 years is more hazardous than one that has a major earthquake every 300,000 years. It is up to the user to decide what degree of fault activity is considered "dangerous." Depending on the intended use of the land (residences, hospitals, schools, picnic grounds, etc.), different degrees of fault activity and risk may be acceptable. Understanding the degree of fault activity is important when deciding whether to build across the fault and when estimating probabilities of ground shaking at varying distances from the fault.

A **Holocene** criterion (10,000 years) for potential fault activity has significant precedence, principally from past usage in California. For purposes of implementing the Alquist-Priolo Earthquake Fault Zoning Act, California Code of Regulations defines an active fault as Holocene Active, that is, active within approximately the past 11,000 years, although local governments may use a broader definition. The Holocene Active definition also has a practical applicability, because climate change following the most recent glaciation has created many recognizable soil horizons and geomorphic surfaces used to date fault activity. However, the Holocene Epoch does not encompass the full range of typical average earthquake recurrence intervals (average earthquake repeat times) along faults in the Basin and Range Province, and major historical earthquakes have occurred in the Province along faults without previous Holocene activity.

A **late Quaternary** criterion (130,000 years) uses the onset of the Sangamon interglacial period as a datum and encompasses many of the average recurrence intervals in the Basin and Range Province. All but one of the major historical earthquakes occurred in the Province along faults with late Quaternary activity

The **Quaternary** Period (1,800,000 years) represents the onset of a major climatic change to the current cycle of glacial/interglacial intervals, during which most of the surficial alluvial deposits and present landscapes in the Basin and Range Province were formed. All the major historical earthquakes in the Province have occurred along faults with Quaternary activity. A Quaternary criterion encompasses essentially all the faults that might produce future earthquakes.

The Basin and Range Province is a large extensional tectonic domain with thousands of normal-slip and strike-slip Quaternary faults that appear to be involved in contemporary deformation. Large earthquakes in the Province commonly involve multiple, distributed faults and have occurred along faults with a wide range in the time since their most recent surface-faulting earthquakes. This tectonic behavior contrasts with the more focused, higher slip-rate tectonics of the plate boundary system in western California. These different characteristics may warrant different considerations, such as the activity criterion used when establishing fault setbacks and identifying potential earthquake sources.

The identification of faults that pose earthquake hazards requires application of a fault-activity criterion to filter out ancient faults that are unlikely to rupture during future earthquakes. This criterion allows society to develop guidelines for potential surface-rupture sources and for potential ground-motion sources. Two fundamental pieces of information characterize fault activity: the displacements that occurred during earthquakes and the rate at which earthquakes occur, which for some faults can be measured as the average recurrence interval between earthquakes.

In the Basin and Range Province, major historical earthquakes have occurred on faults with Holocene activity and on faults that lacked Holocene activity. The most dramatic case is the 1887 Sonoran earthquake in northern Mexico. Different lines of reasoning suggest that 100,000 to 200,000 years had elapsed since the previous surface-faulting earthquake on that fault (Bull and Pearthree, 1988). The 1954 Fairview Peak, Nevada earthquake (Bell and others, 2004) is another example of a major historical earthquake on a fault that lacked Holocene displacement (Pearthree, 1990; Caskey and others, 2004). The 1954 Dixie Valley, Nevada earthquake occurred on a fault zone that has evidence of Holocene activity, but ruptured major portions of fault traces that lacked prior Holocene displacement (Bell and Katzer, 1990). Major earthquakes have occurred along faults with Holocene displacement as well, such as the 1983 Borah Peak, Idaho earthquake (Hanks and Schwartz, 1987). More than half of the major historical earthquakes in the Province included surface faulting along traces which appear to lack Holocene activity. This is an important consideration when determining activity criteria for fault setback distances in the Basin and Range Province.

Earthquakes on faults within the Basin and Range Province have a wide range of recurrence intervals, from hundreds of years to hundreds of thousands of years. Recurrence intervals of a few thousand to tens of thousands of years are typical. One of the most recent and detailed paleoseismic studies in the Province was undertaken as part of the site characterization of the proposed high-level nuclear waste repository at Yucca Mountain, Nevada. That study revealed that average recurrence intervals for many of the faults at and near Yucca Mountain are between 20,000 and 100,000 years (e.g., Wong and others, 1995). A theoretical average earthquake recurrence interval can be determined by considering a typical range of slip rates for faults in the Basin and Range Province (0.01 to 0.3 mm/yr) and typical surface displacements during major earthquakes (1 to 3 m). This yields a range of hypothetical average recurrence intervals of 3,000 to 300,000 years.

Consideration of the historical earthquake record and average earthquake recurrence intervals are principally geologic constructs. They should be evaluated along with other considerations related to levels of acceptable risk and the costs and benefits associated with addressing earthquake hazards for a specific purpose. It is ultimately up to the user to decide how the hazard should be addressed.

Facilitation and Communication

WSSPC recommends that government agencies, regulators, and owners consider these active fault definitions when determining which faults are important for specific facilities or purposes. For some facility types, active fault definitions are already contained in state and federal regulations. Such regulations commonly use different active fault definitions based on the societal importance of the facility being built. Definitions including less active faults (or requiring more restrictive mitigation measures) are typically used for more critical facilities.

When assessing the importance of faults, factors to consider are the type of facility and its societal importance; level of acceptable risk; goals, costs, and benefits of risk reduction; and geologic practicality of applying the definition. An example of the latter is found in areas of the Basin and Range Province where pervasive latest Pleistocene pluvial lake or glacial deposits make use of a Holocene criterion straightforward and practical, but use of a late Quaternary criterion where faults of that age are deeply buried would be impractical. The expense of risk-reduction measures must be justified based on the probability of occurrence and resulting risk to society in terms of public safety and potential economic loss. Use of these three broad definitions (Holocene, late Quaternary, Quaternary) should make choosing the appropriate activity class for a proposed facility relatively straightforward. It is ultimately up to the regulator and owner to decide how the hazard should be addressed, although uniform treatment among Basin and Range Province states is desirable.

WSSPC recommends the Basin and Range Province Earthquake Working Group discuss the application of these active fault definitions at their planned 2006 meeting(s) to determine whether consensus can be reached regarding appropriate active fault definitions in the Basin and Range Province for various facility types. If consensus is achieved, the results can then be communicated to regulators and other users by WSSPC state representatives in their respective states to try to get them adopted and widely used.

Assessment

The success of this Policy Recommendation can be assessed based on the use of the definitions by states and local governments in regulations and ordinances. The U.S. Geological Survey, Utah, Nevada, Colorado, and Clark County, Nevada have already adopted these definitions of active faults in an earlier version of this WSSPC Policy Recommendation. A periodic assessment of these and other federal, state, and local entities will be made to determine the extent to which these definitions are being incorporated into future seismic-hazard rules, regulations, and guidelines.

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History

First adopted in 1997 as WSSPC Policy Recommendation 97-1. Reviewed and re-adopted as WSSPC Policy Recommendation 02-3 by unanimous vote of the WSSPC membership at the Annual Business Meeting September 18, 2002. Reviewed, revised, and re-adopted as WSSPC Policy Recommendation 05-2 by unanimous vote of the WSSPC membership at the WSSPC Annual Business Meeting September 12, 2005.

WESTERN STATES SEISMIC POLICY COUNCIL
POLICY RECOMMENDATION 05-3

Real-Time Earthquake Monitoring Networks

Policy Recommendation 05-3

WSSPC advocates the continuation and expansion of real-time earthquake monitoring networks as envisioned and supported by the Advanced National Seismic System (ANSS). ANSS emphasizes strong-motion instrumentation of urban ground-motion monitoring sites and selected engineered structures as well as increased broadband seismograph instrumentation. The resulting data provide better understanding of future ground shaking potential and insights for the 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. WSSPC encourages the USGS to strengthen partnerships to further these efforts with emergency managers, engineers, and corporate response and business interruption planners, as well as State and local agencies.

Background

Earthquake monitoring networks are vital both to respond to earthquakes and to characterize 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 analyses. Automated processing of earthquake information by seismic networks in the United States provides near-real time information on earthquake locations and magnitude. In the last few years, seismologists have expanded the capabilities of the seismic network system in some areas to routinely produce ShakeMaps, fault orientations and slip distributions, and aftershock probabilities. In California, ShakeMap has become a valuable tool to assist emergency responders in identifying the possible extent of earthquake damage. Finally, strong-motion data (now increasingly available in real-time) are essential to evaluate the engineering relationship of structural damage to severity of ground shaking.

During the 1970s, the U.S. Geological Survey (USGS) began to operate, support and coordinate local seismic networks that were sensitive enough to detect microearthquakes, including aftershocks of larger earthquakes. Data from these early seismograph networks were used to delineate the spatial relationships between earthquake epicenters and active faults. Earthquake networks provide fundamental earthquake data in the form of catalogs describing hypocenter location, time of occurrence, and magnitude. These data find uses in diverse applications ranging from earthquake hazard analysis to disaster response. Data from seismic networks throughout the U.S. provided fundamental data for the U.S. Geological Survey's National Seismic Hazard Mapping Project, which is generating 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 field of seismology through an improved understanding of the physics of earthquake occurrence.

Despite the importance of its products, earthquake monitoring in the United States faces many problems and challenges, the most notable of which are:

- Outdated, inadequate instrumentation
- Separation of functions between strong- and weak-motion monitoring system

- Lack of uniform geographic coverage in areas at risk
- Lack of uniform operational standards
- Well-established independent networks with non-standardized and even incompatible equipment, operations, products, and funding sources.

Many of the currently deployed instruments record only high frequency (1-25 Hz), vertical motions over a very limited dynamic range. Known as "short-period" seismographs, these analog instruments are extremely sensitive, recording even tiny microearthquakes. However, moderate and larger magnitude earthquakes drive short-period seismograph signals off-scale. The full amplitudes of shaking cannot be recorded and the resulting waveforms are highly distorted.

For the western states, modern monitoring of earthquakes is crucial. The largest population of the Nation's seismic risk is in the western states. Large earthquakes are not limited to California. Two of the largest earthquakes in the lower 48 states during the past four decades have occurred in the Northern Rocky Mountain region (magnitude 7.5 1959 Hebgen Lake, MT; and magnitude 7.3 1983 Borah Peak, ID). Yet, the Northern Rocky Mountain region remains the largest seismically active region of the lower 48 states without modern instrumentation.

The recent advent of digital instrumentation has revolutionized seismology. High fidelity earthquake data transmitted in real-time via terrestrial and satellite communication links and modern analysis techniques rapidly provide data essential for all aspects of seismology. Modern dataloggers coupled with broadband and strong-motion sensors have the capability to record the full spectrum of earthquake-related movements—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 the single direction of ground motion recorded by most current network 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. All this information is now immediately posted to the Internet, and datacenters provide ready access to the information for research.

The vision of a next-generation National Seismic System, the Advanced National Seismic System (ANSS) has been prepared by the U.S. Geological Survey, which has now begun its implementation. Its design 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 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 in 2000, the USGS has fostered the organization of seven regional networks developed through incorporation of local efforts into regional systems. The seven networks are in California, the Pacific Northwest, Alaska, Hawaii, the Intermountain region, the Central U.S. (including the Southeast), and the Northeast. With USGS support, the newly established ANSS regional networks have installed almost 400 free-field monitoring stations in 13 states since its inception. The largest numbers are in Alaska, California, Nevada, Utah and Washington, and most stations have been installed in urban areas where seismic risk is high.

Automated processing of earthquake information by seismic networks provides near-real-time information on the Internet 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 severity of ground shaking developed from ground-motion data recorded by the newly installed ANSS instrumentation. ShakeMaps are posted to the Internet within minutes following earthquakes and also are distributed through technologies like CISN Display and ShakeCast. The initial maps are automatically revised as new seismic data become available. In areas of California with a good distribution of strong-motion seismometers, ShakeMap can help emergency managers identify areas most likely to have been exposed to strong shaking in the immediate aftermath of an earthquake before damage reports are available. ShakeMap is being used in conjunction with earthquake loss modeling to make preliminary estimates of earthquake damage costs.

The planned ANSS instrumentation of engineered structures to monitor their responses to earthquake ground motion is just beginning. Because of limited funding, only a few buildings have been instrumented so far. This type of monitoring is very important to the establishment of better building code requirements and designs to achieve improved earthquake resistance in both new construction and retrofitted structures. Following damaging earthquakes, real-time monitoring of the performance of lifelines and buildings will also be valuable in emergency response.

Facilitation and Communication

WSSPC recommends expansion of the regional free-field real-time earthquake monitoring in the western states and throughout the Nation. WSSPC also endorses the expansion of monitoring of engineered structures in order to use insights from investigation of their earthquake performances in creation of better construction standards and designs. To accomplish such expansion, WSSPC encourages the USGS to form partnerships to further these efforts with the emergency managers, engineers, corporate response and business interruption planners, as well as State and local agencies. In addition, recognizing the synergistic aspects of the National Science Foundation's EarthScope Program, which is deploying seismic and GPS instruments, WSSPC encourages the USGS to take full advantage of EarthScope instruments in fulfilling the mission of ANSS. WSSPC will communicate this recommendation to the USGS and to key members of Congress.

History

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7. Annual State Reports

Alaska Division of Geological & Geophysical Surveys

The Alaska Division of Geological & Geophysical Surveys (ADGGS) conducted its second field season in a multiyear, state-funded project to perform detailed geologic mapping and hazards evaluation, including earthquake hazards, along a 200-mile portion of the proposed natural gas pipeline corridor. The proposed gas pipeline will deliver "stranded" North Slope gas to the conterminous U.S. and other markets. The 12-mile-wide study corridor begins at Delta Junction, where the proposed pipeline would depart from the existing Trans-Alaska Oil Pipeline corridor, and follows the Alaska highway to the Canadian border. High-resolution airborne geophysics, acquired in 2005, indicate that at least one fault zone that had previously been identified as separate faults on either side of the corridor is continuous across the corridor. Geologic studies, including trenching, aim to determine the style of offset and long-term slip rates along this and other faults, as well as associated earthquake hazards. Although one major geophysical lineament shows no geologic indications of post-glacial offset, at least two other faults in the corridor, including a newly discovered range-front thrust, show strong signs of recent activity. We are awaiting results and analysis of field and laboratory data to determine recent offset history. ADGGS provided logistic support to the University of Alaska Geophysical Institute (UAGI) for installation of two new seismic stations in this corridor to improve detection and location of earthquakes. Geologic work will continue in the corridor for at least two more field seasons.

ADGGS continues to participate in a cooperative paleoseismicity project with the University of Durham, England, to use coastal-marsh microfossils (primarily diatoms) to reconstruct the details of relative sea-level changes during and between great subduction earthquakes in the Cook Inlet region. The data will help determine the long-term recurrence frequency of 1964-style earthquakes and may provide a basis for developing a forecasting capability for future similar events.

The University of Alaska Geophysical Institute (UAGI) in Fairbanks operates the Alaska Earthquake Information Center (AEIC, www.aeic.alaska.edu) with primary support from the State of Alaska, the National Oceanic and Atmospheric Administration (NOAA), and U.S. Geological Survey. AEIC records and analyzes Alaska earthquake data and disseminates earthquake information to the public. AEIC monitors seismicity in the state and surrounding regions using a network of roughly 500 stations of seismic data. More than 17,000 earthquakes were processed and cataloged for the year through November 2007. AEIC staff responds to significant earthquakes on a 24-hour basis and faxes or emails information releases on felt events to interested agencies, individuals, and the media within 1/2 hour. The UAGI seismology lab continues to participate in Education and Outreach activities, and in particular now in cooperation with the Murie Science and Learning Center at Denali National Park, to develop workshop demonstrations and curricula for Alaska K-12 teachers, as well as improved displays for Park visitor centers.

The efforts of the Plate Boundary Observatory part of EarthScope in Alaska continued in summer of 2007 with the installation of additional permanent Global Positioning System (GPS) and Seismic stations. These observations will provide very interesting and useful data on the continuing deformation occurring within Alaska.

As part of the National Tsunami Hazard Mitigation Program (NTHMP), UAGI and ADGGS continue their collaboration on tsunami-inundation mapping projects with funding from NOAA.

Modeling is near completion for Seward, including simulation of tsunami waves and run-up resulting from multiple submarine landslides. The Alaska Tsunami Hazard Mapping Team has visited Sitka, Seward, and Valdez to establish close coordination with local officials for both information and data purposes. In conjunction with this program, UAGI is upgrading and augmenting the seismic network with modern digital broadband seismic stations. All 21 planned sites have been installed and are being maintained and shared among the earthquake and tsunami processing centers. In addition, more sites are

being installed with University resources. Additional University/NOAA project funds are assisting in a joint enhancement of the Alaska Tsunami Warning Center seismic network. NOAA is providing upgraded (Very Small Aperture Terminal (VSAT) telemetry while AEIC is providing modern broadband instrumentation.

UAGI is participating in a new NSF-funded project in southern Alaska to explore the tectonics and related processes of the Yakataga collision. As part of this effort, 22 new seismic stations, installed in 2006, continue to provide real-time telemetry back to UAGI. These new data feeds allow much more precise locations of events associated with the areas of the large earthquakes near the Mt. St. Elias and the surrounding region.

Other current UAGI earthquake-hazards research projects include:

- Accurate cataloging of ground-motion characteristics and spatial parameters of Alaskan earthquakes
- Crustal deformation measurements using GPS and Synthetic Aperture Radar (SAR) interferometry
- Tsunami Warning and Environmental Observatory (TWEAK) is a collaborative project to improve observation, modeling and mitigation of the effects of large earthquakes and tsunamis
- National Science Foundation (NSF)/Incorporated Research Institutions for Seismology (IRIS) /Program for the Array Seismic Studies of the Continental Lithosphere (PASSCAL) Collaborative Research to study the St. Elias Erosion/Tectonics Project (STEEP)
- NSF/IRIS/PASSCAL transect south of the Alaska range to evaluate crust & upper mantle Structure
- Study of crust and upper mantle structure and attenuation in Alaska
- Upgrade and expansion of the Alaska seismic network through the federally funded Advanced National Seismic System (ANSS). ShakeMaps are now being produced by AEIC, and shortly will be the official center for ShakeMaps for all of Alaska.

Submitted by Rod Combellick, Deputy State Geologist, Alaska Division of Geological & Geophysical Surveys and Roger Hansen, State Seismologist, University of Alaska Fairbanks

Alaska Division of Homeland Security and Emergency Management

Partnerships
The State of Alaska's Division of Homeland Security and Emergency Management (DHS&EM) organized its mitigation, earthquake, tsunami, and preparedness programs under the Mitigation Section to ensure the public is educated about the interrelationship of these natural hazard threats. DHS&EM takes great pride in our partnerships with: the University of Alaska Fairbanks Geophysical Institute (UAF/GI), Alaska Department of Natural Resources Division of Geological and Geophysical Survey (DNR/DGGS), Alaska Earthquake Information Center (AEIC), Alaska Department of Transportation and Public Facilities (AKDOT&PF), West Coast / Alaska Tsunami Warning Center (WC/ATWC), National Weather Service (NWS), National Oceanographic and Atmospheric Administration's Pacific Marine Environmental Laboratory (NOAA/PMEL) and Tsunami Inundation Mapping Effort (TIME), Federal Emergency Management Agency (FEMA), the U.S. Department of Interior (DOI), and Alaska's local, tribal and borough governments. Very few projects would be accomplished without quality partnerships and willing participation.

Commission Involvement
The Alaska Seismic Hazard Safety Commission is active in developing effective practices and policies for earthquake loss-reduction while pursuing accelerating implementation of these policies. DHS&EM State Hazard Mitigation Officer, Mark Roberts, was nominated to serve as one of the eleven commission board members this year. The Commission members meet monthly to focus on prioritizing and identifying earthquake related hazard threats including: critical facilities' structural stability, earthquake insurance necessity and availability, approaches to incorporating seismic risk mitigation into future construction, changes to response and recovery practices to mitigate future seismic risk, hazard identification, and public education outreach initiatives.

Post-Disaster Damage Assessment (PDDA)
DHS&EM aggressively supports and provides funding to the statewide Post-Disaster Damage Assessment (PDDA) training program managed by the Municipality of Anchorage's (MOA) Building Safety Officer. The PDDA Coordinator conducts the modified ATC-20 courses to provide initial and recertification training for Post-Disaster Damage Assessment Evaluators. These evaluator team members assess a building's structural integrity for safe occupancy following a catastrophic event. The PDDA Coordinator is working with the DHS&EM Mitigation, Training and IT Sections to develop a statewide training database and identification cards. The State currently has approximately 650 trained and certified damage assessors.

Quake Cottage Earthquake Simulator
Two of the Division's innovative outreach tools, the "Quake Cottage" earthquake simulator and the "Earthquake Resistant Model Home," continue to generate requests supporting non-structural seismic hazard mitigation demonstrations. These tools provide audiences effective earthquake preparedness and mitigation lessons as well as build visual relationships about the effects of hazards affecting structures and contents. Although the "Quake Cottage" activities were scaled back for 2007, the Division has delivered our preparedness message to over 2,500 people this year at schools, the Nenana Fair, Kenai River Days Festival, the Governor's Annual Picnic, and various other central Alaska outreach events.

Preparedness
DHS&EM provided funds for printing 2,000 copies each of the children's books "Molly and the Earthquake" and "Heidi and the Tsunami". High School Senior Ms. Hanna C. Watkins designed, wrote, and illustrated the books for Kindergarten through Fourth Grade students. The books tell fictional stories of a family's natural hazards experiences and give safety tips on what to do before, during, and after an event. These publications are distributed throughout the state at various outreach venues. DHS&EM is excited that we can add them to our outreach resources. The books are available for download at: *http://www.borough.kenai.ak.us/emergency/books/watkins.htm*. DHS&EM Staff participated in a UAF

education program that will teach high school students basic GIS and hazard mapping. The program targets specific native communities having significant seismic and tsunami threats along the Aleutian Chain.

Improve techniques to reduce seismic vulnerability to facilities and systems
Two real time earthquake-monitoring systems supplied by UAF/GI and USGS are used in the State Emergency Coordination Center (SECC). These systems provide immediate earthquake notification showing seismic station depictions of a quake and related scientific data. The systems graphically relate the earthquake data to adjacent communities, allowing the SECC to quickly contact communities and gather impact data for potential post disaster damage estimates. The State of Alaska received two FEMA Pre-Disaster Mitigation-Competitive (PDM-C) grants for 2006. The Kodiak Island Borough School will receive seismic retrofitting and 10 Anchorage Schools will receive automatic gas shut-off valves. The Kodiak project ranked number one in the nation from the FEMA review panel.

Improve seismic hazard identification and risk assessment methods and their use
The State is using VRiskMap® software to facilitate risk and vulnerability analysis from earthquakes and other natural hazards. The software allows Mitigation Staff to overlay hazard maps, delineate by degree of hazard, and run queries giving population and infrastructure-associated information to determine potential impact and estimated losses. Several of Alaska's largest communities and boroughs have FEMA-approved and community- adopted Local All-Hazard Mitigation Plans fulfilling the Disaster Mitigation Act of 2000 criteria. These plans are essential for identifying the risks, vulnerabilities, and the economic impact to the State's population and infrastructure from natural hazards like the State's extensive earthquake hazard. These plans cover approximately 83% of the State's population. Several of the remaining communities are developing Local Hazard Mitigation Plans to align their local hazard mitigation plans, hazard data, strategies, goals, and initiatives with the State Plan.

Mapping
NOAA and the State of Alaska sponsored Tsunami Inundation Mapping projects for Homer and Seldovia. This project provides potential tsunami mapping coverage to enable local community partners to tailor the information obtained from the inundation maps toward their emergency response and planning efforts. These maps will assist the communities with preparing for, and mitigating against, potential tsunamis. The Alaska Division of Geological and Geophysical Survey produce the final maps for planning and distribution by the local government and emergency management. UAF/GI is currently researching tsunami potential for the Cities of Seward, Sitka, and Valdez, Alaska.

Submitted by Brent Nichols, Earthquake Program Coordinator, Alaska Division of Homeland Security and Emergency Management

Provincial Emergency Program, Emergency Management British Columbia

2007 was a very productive year for the Provincial Emergency Program (PEP) in British Columbia (BC). Seismic planning was moved to the forefront of hazard planning with the launch of the Seismic Integrated Response Planning (SIRP) Project.

Earthquakes
The SIRP project has been developed to facilitate the refresh of the British Columbia Earthquake Response Plan. A two-year strategy outlining this project, which will culminate in a fully refreshed provincial earthquake response plan, has been developed. This plan will build upon the strong foundation of the British Columbia Emergency Response Management System (BCERMS), the Provincial Regional Emergency Operations Centres (PREOCs), and the Temporary Emergency Assignment Management System (TEAMS). The refreshed plan will be a fully operational document including realistic planning assumptions, response actions, and functional components, all of which will help to coordinate response and support local governments in an effective and efficient manner following an earthquake

A Steering Committee has been assembled to oversee this project. This committee is composed of emergency management experts from Provincial, Federal and Local governments and First Nations as well as a leading earthquake scientist and communications expert. Additionally, Henry Renteria, Director of The Governor's Office of Emergency Services for the State of California has volunteered to act as an external advisor to this committee. We are extremely pleased to have Henry involved with this project. His experience and expertise is an invaluable resource.

Under direction of the Steering Committee, working groups have been established to facilitate scenario development, exercise planning, communications, and building response actions.

Fortunately, the Province of BC has not experienced a major damaging earthquake in modern times and we are looking internationally to learn from others who have hands-on experience with major earthquakes: how they responded, and how they recovered, and the lessons learned. This evidence based research will be used to form a basis for our planning assumptions. Building on this, a series of plausible earthquake scenarios throughout the province will be used to generate response actions.

A strong emphasis has been placed on collaboration with academic organisations this year. Students from The School of Community and Regional Planning at The University of British Columbia, The School of Earth and Ocean Sciences at The University of Victoria, and in Disaster and Emergency Management at Royal Roads University have been engaged in various projects related to seismic hazard planning. Additionally, collaboration and liaison with federal earthquake, tsunami, and volcano scientists continues with the desire to integrate scientific research with practical human consequence management for the emergency management community.

Tsunamis
The Tsunami Integrated Preparedness (TIP) project, initiated by PEP after the devastating tsunami in South Asia was a two-year project that worked closely with stakeholders including Federal, Provincial, and Local governments, communities, private industry, First Nations, humanitarian organisations, and the media to coordinate these partners and ensure the enhancement of BC's tsunami preparedness.

Under the TIP project, $1 million in funding was provided by the Province, as well as $500,000 from Indian and Northern Affairs Canada and $350,000 from Public Safety and Emergency Preparedness Canada to British Columbia coastal communities for tsunami preparedness. Twenty-one high risk communities received $20,000 each and forty-three lower risk communities received $10,000 each for preparedness initiatives.

Some of the key deliverables of the TIP project are a refreshed BC Tsunami Notification plan, an enhanced Provincial Emergency Notification System (PENS), Weatheradio capability for tsunami notifications, tsunami signage for at-risk communities, a Warning and Alerting Toolkit for Local Authorities, numeric wave modeling, and an educational website that can be found on the PEP website at *www.pep.bc.ca*.

Volcanoes
PEP worked closely with Natural Resources Canada to refresh the Interagency Volcanic Event Notification Plan. This plan outlines notification procedures for volcanic events within and outside of Canada. This plan was fully refreshed and tested this year.

Ongoing earthquake and tsunami outreach continues: promoting awareness of seismic hazards throughout the Province and encouraging preparedness by reaching out to communities, local governments, private industries, other provincial ministries, and federal organisations. We are also working with a school district in the Metro Vancouver region on earthquake awareness, safety, and planning, with the goal of enhancing earthquake education in the curriculum throughout the Province.

The Provincial Emergency Program continues to be an active participant in the WSSPC, the Cascadia Region Earthquake Workgroup (CREW), and has played a key role in the planning the 2008 National Earthquake Conference.

Submitted by Maiclaire Bolton, Seismologist, Provincial Emergency Program, Emergency Management British Columbia.

California Geological Survey

Working Group on California Earthquake Probabilities

In 2007 the California Geological Survey (CGS) participated in the Working Group on California Earthquake Probabilities (WGCEP). This is the latest in a series of Working Groups (WGCEP 1988, 1990, 1995, and 2003) that were established to evaluate the probability of future large earthquakes in California. The current WGCEP is a joint committee composed of staff from the USGS, the Southern California Earthquake Center, and CGS, with funding support from these agencies and the California Earthquake Authority. CGS geologists and seismologists contributed to the collection of information on faults and historic seismicity, and to the development of models in which that information is used to calculate seismic hazards. WGCEP 2007 prepares the statewide forecast by adopting previous Working Group results where possible, and updates past results only when compelled to by new data, or by necessity to conform the analysis to a uniform statewide approach and with the National Seismic Hazard Map Program (NSHMP) assessment.

The WGCEP 2007 report differs from past WGCEP efforts by:

- reporting earthquake probability for the entire state of California instead of regions;
- using uniform methodology across all regions;
- using the same earthquake rate model as the NSHMP;
- compiling and using updated, uniform, and publicly accessible statewide data;
- developing new methods to make models more rigorously adherent to observational data, particularly fault slip rates (moment balanced);
- making analysis tools and data available through a public, web-based interface.

Seismic hazard models developed by the WGCEP were incorporated into the National Seismic Hazard Maps, and delivered to the Building Seismic Safety Council and the California Earthquake Authority (CEA) in October 2007. These models are the primary seismic hazard background for incorporation into future building codes, through the BSSC, and for calculating earthquake insurance rates through CEA. Reports of the WGCEP, including new estimates of the probability of significant earthquakes on California's faults will be completed in early 2008.

Southern California Earthquake Planning Scenario

CGS is participating in the Multi-Hazard Demonstration Project (MHDP), an "earthquake planning scenario" for a 7.8 magnitude event on the south-central segment of the San Andreas Fault. CGS has analyzed earthquake ground failure hazards in select focus areas where numerous utility and transportation lifelines either cross or are near the area of the scenario fault rupture. The scenario earthquake ruptures the San Andreas fault from Lake Hughes in the Transverse Range to Bombay Beach at the north end of the Salton Sea. CGS has concentrated specifically on earthquake triggered displacements of identified existing or potential landslides within two focus areas: 1) Cajon Canyon Focus Area in the eastern Transverse Ranges; and, 2) San Gorgonio Pass Focus Area near Palm Springs. The stability analyses performed involved: 1) evaluating and selecting landslides and slopes within the focus areas that are most likely to impact roadway, railway, and utility lifelines; 2) creating topographic profiles across selected slopes; 3) inferring subsurface geologic and hydrologic conditions from stereo aerial photograph geomorphic analyses and field reconnaissance, and preparing geologic cross-sections along topographic profiles; 4) performing static slope stability analyses to refine subsurface geologic interpretations and material strength characteristics; 5) performing pseudo-static slope stability analyses to determine yield acceleration for each slope; and 6) estimating ranges of seismically induced slope displacements.

The analyses show that, in the Cajon Pass area, several lifelines, including high-voltage powerlines, railroads, natural gas lines and fiber-optic conduits will be impacted by earthquake-induced landslides. In addition, large road-cut slopes could be the source for rockfall hazards for Interstate 15. Large fill prisms constructed for I-15 will have seismic compression/settlement and possibly have lateral failures during

the scenario event. Along Interstate 5 north of Santa Clarita there will be rockfalls at various cut-slopes, but the scenario ground motions are not large enough to trigger significant movement at existing landslides near Pyramid Lake. In the San Gorgonio Pass area, Interstate 10 and high-voltage power lines will be impacted by landslide movement. The landslide displacement estimates will be combined with the modeled shaking and surface fault displacement to estimate lifeline damage from the earthquake and time-to-repair.

Other Activities

During the past year, CGS reviewed 340 geologic/seismic hazard reports for new school construction and 43 for new hospital construction or retrofit of existing hospitals for compliance with the California Building Code.

On October 30, 2007, the California Earthquake Prediction and Evaluation Council (CEPEC) met and advised the Governor's Office of Emergency Services that the M5.4 Alum Rock earthquake had significantly increased the likelihood of a damaging earthquake along the Hayward fault and/or the Calaveras fault. With the passage of time, the likelihood that the Alum Rock earthquake was a foreshock of a larger event had naturally decreased. However, recent earthquake history in California suggested to CEPEC that the possibility of further activity remained. The 1992 Landers earthquake was preceded by the Joshua Tree earthquake, 2 months earlier. And the 1989 Loma Prieta earthquake was preceded by the Lake Elsman earthquakes, 2 and 16 months earlier. Therefore, CEPEC advised OES that the likelihood of damaging earthquake activity along the Hayward or Calaveras fault will continue to be elevated, albeit at a lower level, over the next year or so. CEPEC did not recommend any specific action at that time except the awareness that potential for further activity exists and that the citizens of California should maintain a prudent level of earthquake preparedness.

Submitted by John G. Parrish, Director and State Geologist, California Geological Survey

California Governor's Office of Emergency Services

The Earthquake and Tsunami Branch of the Office of Emergency Services (OES) works with other OES branches, state agencies and scientific organizations to promote the safety of California residents through a statewide program of planning and technical assistance, public education, and information and technology transfer to public and private sector organizations. The goals of the Branch are 1) to promote the utilization of new technologies for recording, evaluating and assessing earthquakes and tsunamis and their impacts to improve warning, response and recovery; 2) maintain an active liaison with elected officials, emergency managers, professional associations, the news media and other targeted groups for the purpose of knowledge and technology transfer; 3) draw on lessons learned from damaging earthquakes and tsunamis in the state and around the world to raise awareness of the earthquake and tsunami risk in California and promote preparedness and mitigation planning; and finally 4) to monitor research in all relevant fields to assure that information and technologies transferred are state-of-the-art.

Highlights:

- Held tsunami planning workshops in several counties including San Diego, Humboldt, Del Norte, Monterey, Marin, Mendocino, San Francisco and Los Angeles. In conjunction with the Humboldt, Del Norte and Mendocino workshops, tabletop exercises were held.

- Convened the California Tsunami Steering Committee on June 26, 2007. OES chairs this committee which is made up of representatives of 15 California Coastal Counties, representatives of Caltrans, the California Geological Survey, the California Seismic Safety Commission and the National Weather Service Forecast Offices in Eureka, Monterey, Oxnard and San Diego.

- Represented California at National Tsunami Hazard Mitigation Program meetings in Silver Spring, Maryland in October 2006 and in Seattle, Washington in March 2007.

- Initiated planning for California's first end-to-end tsunami communications test to be held in Humboldt County in March 2008.

- Worked with the University of Southern California Tsunami Research Center to develop a second generation of tsunami inundation projections and, in collaboration with the OES GIS Unit, will provide maps useful for tsunami evacuation planning for all California coastal counties.

- In cooperation with the National Weather Service, developed a public-private partnership that will help support tsunami public education in California.

- Provided legislative analysis for AB 319 (Nava) a bill that would have established the Tsunami Hazard Preparedness and Mitigation Act of 2007.

- Supported California Specialized Training Institute (CSTI) by providing a lecture entitled "Using Science and Technology in Managing Earthquake Emergencies" in all offerings of the Earthquake Course at the San Luis Obispo campus.

- Promoted the use of ShakeMap and the CISN Display, a real-time earthquake notification system, at numerous meetings of emergency managers in California.

- Supported local government earthquake exercises by providing detailed scenarios that employed both the ShakeMap and HAZUS® loss estimation technologies.

- Represented OES on the Steering Committee of the California Integrated Seismic Network (CISN) and chaired the CISN Outreach Working Group.

- Represented California and the OES Director on the Board of Directors of the Western States Seismic Policy Council (WSSPC).

- Served on the Board of Directors of the Cascadia Regional Earthquake Working Group and, in that capacity as well as that of WSSPC, contributed to planning for the 2008 National Earthquake Conference to be held in Seattle, Washington in April 2008.

- Participated in a multi-agency effort to promote earthquake preparedness in southern California through a coalition entitled the Earthquake Country Alliance. This coalition is responsible for development of a detailed planning scenario for a M7.8 earthquake on the southern San Andreas fault which will drive the 2008 Golden Guardian Exercise as well as a number of associated events in 2008 designed to highlight the need for earthquake preparedness and hazard mitigation at all levels of the community.

- In cooperation with the OES Hazard Mitigation Branch, developed an interactive web portal that allows users to enter an address and identify mapped hazards such as earthquake, hazardous materials storage sites, inundation zones for tsunami and flood and other hazards.

- Provided staff support for the California Earthquake Prediction Evaluation Council (CEPEC) which reviews earthquake predictions for California and provides scientific commentary on seismic potential following the occurrence of California earthquakes that might be precursors to lager damaging events.

- Represented California at the National Earthquake Program Managers meeting in April 2007

- Continued to actively participate in California Post-Earthquake Clearinghouse activities

Submitted by Jim Goltz, Earthquake and Tsunami Program Manager, California Governor's Office of Emergency Services

Colorado Geological Survey and
Colorado Earthquake Hazard Mitigation Council

The Colorado Earthquake Hazard Mitigation Council continues to hold bi-monthly meetings. One of the Council's 2007 projects was the development of a map and accompanying text called "Colorado Earthquake Hazards". This product is intended for use by the general public and should be available in early 2008 in both hard copy and on-line. The map depicts the locations of known and suspected Quaternary faults and historic earthquakes. In addition to information on Colorado's faults and earthquakes, the text lists sources for more detailed information and recommendations on what to do before, during, and after an earthquake, which are found on FEMA's website.

During 2007 the Council initiated efforts to formulate a policy recommendation to the Colorado Geological Survey on appropriate seismic design parameters for use by the Survey when reviewing major construction and renovation projects at public schools. Members of the Colorado Earthquake Hazard Mitigation Council serve on both regional and national committees of the Advanced National Seismic System.

Colorado Geological Survey (CGS) is conducting an investigation of a 95-mile long, 100-ft high escarpment near Anton, Colorado as part of a program to identify Quaternary faults in eastern Colorado. Two benched trenches were excavated in late 2007 using partial National Earthquake Hazard Reduction Program funding to look for evidence of faulting.

One 400-ft long trench was dug beneath a 15-ft deep, filled gully in the main escarpment face. The second, 600-ft long trench was dug beneath a modern playa and a 15-ft high escarpment at the playa margin. The trenches revealed unbroken Pleistocene to Pliocene strata and no evidence of fault rupture.

A total of four trenches have been dug at the Anton site since 2004, from the top to the base of the escarpment (~2,000 linear feet of 15-foot-deep, continuous trench). CGS is now assessing evidence that this feature formed during the past 20,000 years, a result of simultaneous wind erosion and adjacent loess deposition.

Submitted by Vince Matthews, Director and State Geologist, Colorado Geological Survey

Hawaii State Civil Defense and Hawaii State Earthquake Advisory Committee

Hawaii State Civil Defense (SCD) continued to support, through the State of Hawaii Hazard Mitigation Forum, several key working groups during 2007. The Tsunami Technical Review Committee (TTRC) and the Hawaii State Earthquake Advisory Committee (HSEAC) have continued to work with partners in government agencies, the private sector, the University of Hawaii and the Pacific Disaster Center (PDC), in a continuing effort to focus on earthquake and tsunami issues. Additionally, the Tsunami Technical Review Committee (TTRC) now has four active working groups: the Science Advisory Working Group (SAWG), the Public Awareness Working Group (PAWG), the Warning Systems Working Group (WSWG) and a subcommittee of the Public Awareness Working Group, the Tsunami Risk Assessment Project (TRAP).

Earthquake

The Hawaii State Earthquake Advisory Committee (HSEAC) along with the Structural Engineers Association of Hawaii (SEAOH) has been successful in promoting the adoption of a State-wide building code. The building code council that will select the suite of codes for state-wide application is expected to select IBC 2006 as the model building code early next year. This code must then be adopted by all counties, including Hawaii County, within a two year timeframe. Hawaii County will therefore need to transition from the Uniform Building Code 1991 to the International Building Code 2006, a major improvement in seismic and other design provisions. To assist in this transition, HSEAC and SEAOH are organizing a number of code training workshops for building officials and practicing engineers, the first of which was held in October 2007 with 104 attendees.

Subsequent to the Kiholo Bay earthquake in October 2006, HSEAC has been active in promoting retrofit measures for reduction of losses during future earthquakes. FEMA funding has been obtained to perform an investigation of post-and-pier foundation systems (similar to cripple wall crawl space foundations) which contributed to a disproportionately large number of residential building failures. The project will inspect a variety of post-and-pier homes and develop generic retrofit measures that can be undertaken by the homeowner or their contractor without additional professional input. A number of outreach workshops and seminars have been offered in conjunction with this project.

The HSEAC is participating in another FEMA-funded project to transfer the custom Hawaii building inventory database, developed over the past 10 years, from HAZUS®-99 to the latest version of HAZUS® Multi-Hazard (MH) Release 2. Many of the problems identified by HSEAC in earlier editions of HAZUS® have been addressed in the MH version, enabling SCD and PDC to provide improved reports to State and County emergency responders in the event of a future earthquake.

Based on experience gained in the aftermath of the October 15, 2006 Kiholo Bay earthquake, HSEAC has worked with SEAOH to develop a list of volunteers trained in ATC-20 *Procedures for Post Earthquake Safety Evaluations of Buildings* for post-earthquake deployment. They have also developed procedures for State Civil Defense and the County responders to follow in activating these volunteer inspectors.

Tsunami

April is annually proclaimed by the Governor as Tsunami Awareness Month. On April 2, 2007, State Civil Defense conducted a Locally Generated Tsunami exercise. On October 1, 2007, a Distant Tsunami exercise was held. These exercises were coordinated with the monthly testing of the warning sirens. The participants included Pacific Tsunami Warning Center; 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 concurrent with an internal staff exercise at State Civil Defense.

Tsunami mapping continues through an effort coordinated by SCD with the University of Hawaii to upgrade existing one-dimensional tsunami evacuation maps. Currently two-dimensional inundation maps are being generated. These inundation maps will be used to draw new evacuation maps which will replace the current one-dimensional evacuation maps in the telephone books. It is anticipated that the Island of Oahu mapping will be completed as of December 2007. The Museum won a 2007 WSSPC Award in Excellence for its booklet: *Walking & Driving Tours of Historical Tsunami Sites.*

Department of Education/Tsunami Curriculum Project was awarded to the Pacific Tsunami Museum in Hilo, Hawaii in March 2007. This project includes the development, testing, and distribution of a formal educational package which will contain student materials and a teacher's guide in addition to supplemental materials that are "teacher-ready" for expanded lesson plans.

An exhibit documenting the threat of locally generated tsunamis in Hawaii and highlighting the necessary actions to take to prevent becoming a victim will be a part of the Curriculum project. The Pacific Tsunami Museum will develop an exhibit on locally generated tsunamis entitled *Locally-generated Tsunamis - The Halape Story*. It will feature the area where two deaths occurred in the 1975 event.

Through a collaborative effort between SCD and NOAA's Pacific Services Center, a web application has been created featuring an interactive online mapping system. A resident or visitor may enter an address and immediately see the tsunami evacuation zones on the hazard map located in the application. The tsunami awareness tool is easy to use and can be placed on any website. Since the Google Maps interface is provided to developers for customization at no cost, both users and stakeholders may take advantage of this free application. See the user-friendly, on-line format at *www.scd.state.hi.us*.

The United States Geological Survey in cooperation with SCD, the State of Hawaii Office of Planning Department of Business, Economic Development and Tourism, and the PDC worked for the past year on the Tsunami Risk Assessment Project – Phase One. This culminated in a USGS Scientific Investigations Report 2007-5208, the publication of *Variations in Community Exposure and Sensitivity to Tsunami Hazards in the State of Hawaii* by Nathan Wood, Alyssia Church, Tim Frazier, and Brent Yarnal. The purpose of this report was to describe tsunami-prone landscapes on the Hawaiian coast and to document geographic variations in community vulnerability to tsunamis. To understand tsunami risk, policymakers, emergency managers, and private citizens must understand the potential for extreme events and the vulnerability of communities that occupy tsunami-prone land. The report is available at *http://pubs.usgs.gov/sir/2007/5208.*

Hawaii State Civil Defense has an active outreach program that goes to schools, public meetings and other venues to discuss hazard awareness. One of the annual events on the Earthquake and Tsunami Program Planner's schedule is a visit to Manoa Elementary School in April of each year to give a presentation to the 4th graders just prior to their trip the Island of Hawaii to visit the active volcano and historic tsunami sites.

Hawaii State Civil Defense, Hawaii State Earthquake Advisory Committee and Hawaii Coastal Zone Management Program won the 2007 WSSPC Overall Award for Excellence in Mitigation for the jointly produced *Earthquake Hazards and Estimated Losses in the County of Hawaii* available on the WSSPC website at *www.wsspc.org/Awards/2007/HSEAC.pdf.*

Submitted by Jeanne Branch Johnston, Earthquake and Tsunami Program Planner, Hawaii State Civil Defense

Idaho Geological Survey and Idaho Bureau of Homeland Security

Seismic Activity
As of December 7, 2007, 14 earthquakes occurred in Idaho in 2007. Magnitudes ranged from 2.4 to 3.5. All the earthquakes occurred in locations well known for seismic activity, including 7 in western Idaho near Cascade, 3 in central Idaho between Salmon and Clayton, 3 in southeastern Idaho near Soda Springs, and 1 in northern Idaho's Silver Valley. No damage was reported from any of the earthquakes.

Network Activities
The Transportable Array of the EarthScope project moved into Idaho beginning in the summer of 2006, temporarily transforming seismic monitoring. By mid-2007, EarthScope was operating 42 broadband seismic stations in the state. Idaho is attempting to obtain funding to permanently acquire several of these stations. EarthScope is also operating 18 GPS stations in Idaho with the goal of resolving strain rates associated with Cascadia subduction, Basin and Range extension, and Yellowstone Hot Spot magmatism.

Education and Outreach
The annual Idaho Earth Science Educator Summer Field Workshop was held July 8-13, 2007 at Island Park near Yellowstone National Park. The workshop is conducted by the Idaho Geological Survey (IGS) with major funding from the Idaho Bureau of Homeland Security (BHS). As in previous years, the focus was on natural hazard education. Fourteen K-12 educators from around the state attended the workshop. Yellowstone National Park geologists joined with IGS and BHS staff to instruct participants on hazard mitigation, hydrothermal steam explosions, caldera eruptions, and the effects of the 1959 Hebgen Lake earthquake. In October 2007, IGS and BHS cosponsored a display on geologic hazards at the Idaho Science Teachers Association annual meeting in Boise. The display served as both an educational resource and as a recruiting station for future participants at the summer field workshop. The two agencies also cosponsored a teleconference in December for the Idaho Earth Science Teachers Association in which future natural hazard education activities were planned.

Earthquake Mitigation Activities
The first meeting of the Idaho Seismic Advisory Committee was convened on September 6, 2007 in Boise by the IGS and BHS. The meeting was attended by 26 professionals consisting of seismic network operators, earth scientists with expertise on Idaho seismicity, a building code examiner, engineers concerned with roadways and dams, a K-12 educator, and representatives of federal, state, and county government with responsibilities in emergency management and hazard mitigation. The short term objective of the committee was to assist BHS with revision of the 2007 Idaho State Hazard Mitigation Plan. Longer term objectives include identifying research and mitigation priorities and communicating these findings to FEMA, BHS, and the USGS; raising awareness of seismic hazards amongst the general public and elected officials; improving seismic monitoring; and fostering cooperation between the stakeholders responsible for Idaho seismic hazard mitigation. One highlight of the meeting was a presentation by Glenn Thackray (Idaho State University) showing new research results from the Sawtooth Mountains of Idaho. Using airborne Light Detection and Ranging (LiDAR), Thackray and his colleagues detected a previously unrecognized fault beneath heavy tree cover. Preliminary results suggest that the fault offsets Holocene deposits. More work is needed to determine the extent and slip rate of the fault.

In October 2007, the BHS hosted two training workshops in Boise and Idaho Falls as part of their Earthquake Hazard program. The workshops included FEMA's Rapid Visual Screening Training and ATC-20 *Procedures for Post Earthquake Safety Evaluation of Buildings*. Training locations were selected regionally according to the level of seismic risk. Rapid Visual Screening directly supports on-going mitigation planning activities in multiple communities. The Post Earthquake Safety Analysis of Buildings Course was specifically targeted to local building officials to assist damage assessment planning and to strengthen partnerships for long-term seismic risk reduction projects.

On November 2, 2007, the BHS received formal notification that the 2007 State of Idaho Hazard Mitigation Plan had been approved by FEMA Region X. This scheduled update to the Idaho State Hazard Mitigation Plan contains significant improvements to the seismic mitigation section. Identified seismic mitigation actions include conducting detailed seismic analysis of critical state facilities, hospitals and schools, and analysis of Idaho's faults in order to determine their probable hazard.

Submitted by Bill Phillips, Research Geologist, Idaho Geological Survey; Roy Breckenridge, Director and State Geologist, Idaho Geological Survey; and David Jackson, Mitigation Program Manager, Idaho Bureau of Homeland Security

Montana Bureau of Mines and Geology

The northern Intermountain Seismic Belt remained seismically active during the report period of 1 November 2006 through 31 October 2007. Using data from the Montana Regional Seismograph Network, the Earthquake Studies Office of the Montana Bureau of Mines and Geology (MBMG) determined hypocenter locations for 1520 earthquakes during this period. This total included two earthquakes with magnitudes of 4.0 or greater and 19 quakes ranging from 3.0 to 3.9.The largest earthquake during this period occurred on 8 May 2007 with a magnitude of 4.7. It occurred in the Ruby Valley of southwest Montana 8 km southeast of the town of Sheridan, a region of historically low seismicity. The U.S. Geological Survey *Did You Feel It*? website (*http://earthquake.usgs.gov/eqcenter/dyfi*) received 520 felt reports between Cascade, Idaho and Fort Benton, Montana. The maximum reported intensity of V was reported by residents in Sheridan where bricks fell from the cornice of a two-story building and one family was evacuated from a second story apartment. Fortunately nobody was injured but about 40 bottles of liquor fell from the shelves of Booze and Buns, "breaking two bottles of cheap whiskey". Thus far, 125 aftershocks have been located with magnitudes ranging from 3.0 to 0.1.

The second largest Montana earthquake was centered 16 km north of Dillon on 29 March 2007. With a magnitude of 3.5, this earthquake was felt by local residents but caused no damage. It was one of 227 aftershocks of the 26 July 2005 Dillon earthquake (magnitude 5.6) for this reporting period. As of the end of October 2007, the MBMG has determined hypocenter locations for 1288 Dillon aftershocks.

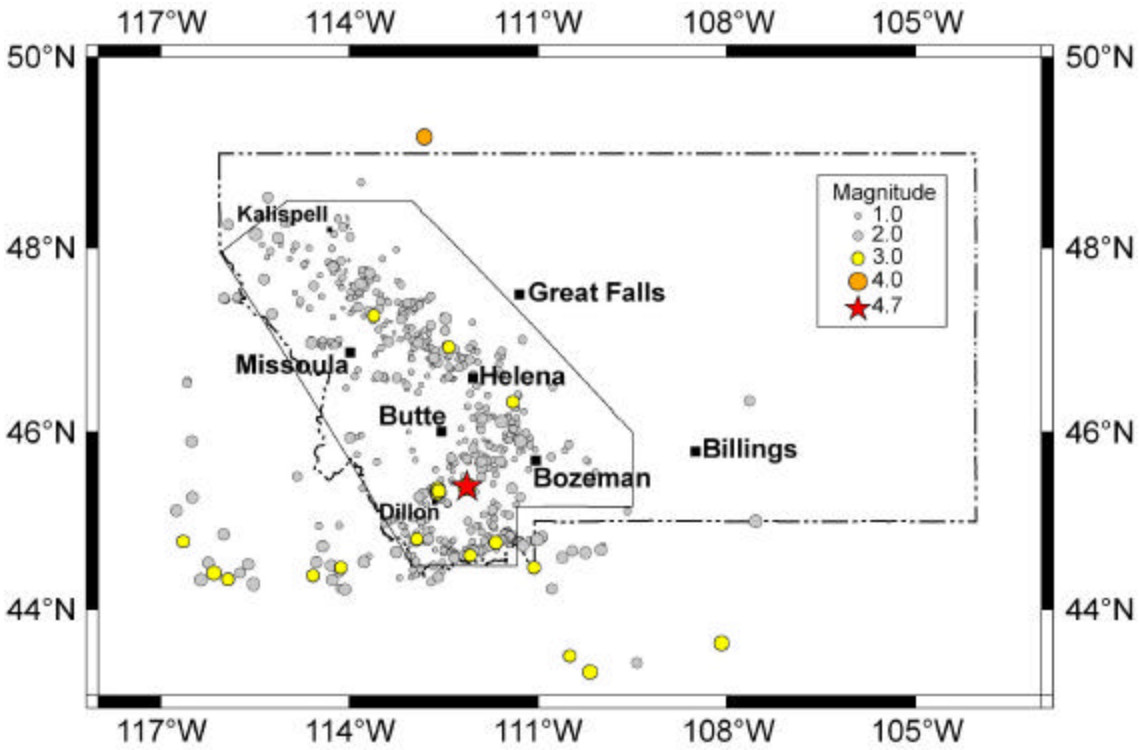
The most energetic earthquake swarm during the reporting period occurred near the small town of Big Arm on the western shore of Flathead Lake. A total of 101 earthquakes occurred from 5 July through 31 October. Numerous earthquakes were felt or heard as loud booms by local residents but the six largest earthquakes of the swarm ranged from 2.2 to 2.4. The majority of the activity occurred between 2 October and 19 October, the dates of the first and last of the "larger" events. Despite the small magnitudes of these earthquakes and abundant historic seismicity in the Flathead Valley, the Big Arm swarm generated a significant amount of public interest.

The Earthquake Studies Office continues to receive funding from the U.S. Geological Survey National Earthquake Hazards Reduction Program Grants Program for partial support of the Montana Regional Seismograph Network. These funds are used for technical assistance with repair and maintenance of seismograph and telemetry equipment, data archival, and general network operations. In early 2007 the US Geological Survey awarded a grant to continue this support for the next 3-year funding cycle, including salary support for a half-time seismic data analyst position. With supplemental funds from the Confederated Salish and Kootenai Tribes and the MBMG we are currently interviewing candidates for a full-time position.

Approximately 40 stations of the Incorporated Research Institutions for Seismology's Transportable Array (*http://anf.ucsd.edu/stations.php*) are currently operating in western and central Montana. Over the course of 2007, we began capturing waveform data from this temporary research array for all local earthquakes and incorporating phase arrival times into routine hypocenter locations. These data have provided significant improvements to our seismic monitoring efforts in terms of spatial coverage of western Montana and first motion data. We now typically have over 40 readings for magnitude 2 earthquakes. With these new data, we have discovered an issue with our S-wave velocity model for stations at epicentral distances beyond ~50 km and now routinely compute excellent fault plane solutions for M2.5+ earthquakes. The incorporation of these data into routine network processing is time consuming but results are well worth the effort.

In September, the State of Montana awarded the MBMG an equipment grant that will allow us to take over operation of 10 Transportable Array sites after the EarthScope experiment moves eastward. Unfortunately, the award is not sufficient to continue operating broadband instruments at the sites. Instead, we plan to install a 3-component strong motion sensor and a short-period seismometer with a 24-bit data logger and digital telemetry at each site. We expect this deployment over the next two years to provide lasting improvements to the coverage and data quality of the Montana Regional Seismic Network

The MBMG is working cooperatively with Butte Silver Bow County on a FEMA Pre-Disaster Mitigation Grant to delineate geologic hazards. Special emphasis will be devoted to the Continental and Rocker faults, poorly studied Quaternary faults near the city of Butte. A detailed geologic map of the County along with new geologic hazards information will be incorporated into the County's hazard mitigation plan by the end of the 30-month study.



Map of 1520 earthquake epicenters from 1 November 2006 through 31 October 2007 determined from Montana Regional Seismograph Network data. The polygon shows the Montana Regional Seismograph Network authorative region.

Submitted by Mike Stickney, Director, Earthquake Studies Office, Montana Bureau of Mines and Geology

Montana Disaster & Emergency Services Division

The Montana Earthquake Hazard Reduction Program continues to demonstrate successful efforts within our state by providing information, training, television programs and support to communities expressing an interest in earthquake preparedness.

Earthquake Preparedness Month, recognized in October, continues its success and is probably the most consistent thing we do to promote earthquake education in Montana. Lewis & Clark County shines as Montana's example in how local emergency managers can take the lead in preparing their communities for earthquakes – and other hazards. Great efforts are made to educate schools, businesses and other groups and present them with information they need to be better informed on risk, preparedness efforts, and the Drop, Cover and Hold Drill. Drills have become an important and expected part of the overall efforts taken within this county to advocate citizen preparedness.

Additionally, communities and schools throughout Montana conduct earthquake drills as part of their yearly drill requirements. Overall, the program does well but most efforts and expectations are limited due to a lack of resources.

Submitted by Monique Lay, Earthquake Program Manager, Montana Disaster & Emergency Services Division

New Mexico Bureau of Geology and Mineral Resources and Department of Earth and Environmental Science at New Mexico Institute of Mining and Technology

With the Earth and Environmental Sciences Division, Los Alamos National Laboratory

Seismic studies

Earthquakes in New Mexico occurred primarily along the northeastern border of the state, associated with the continuing earthquake swarm near Trinidad, Colorado, and northwest of Carlsbad in the southeast part of the state, where a swarm of earthquakes continues near the Dagger Draw oil field, and in the central portion of the state near the Socorro magma body. The largest magnitude earthquake, a magnitude 3.6 on December 24, 2006, in the state within the last 12 months occurred in the northeastern part of the state near Raton. Other notable earthquakes within the past 12 months include an unusual minor event west-southwest of Reserve. This magnitude 3 earthquake, part of a small swarm that lasted several hours on September 8, 2007, produced felt reports up to 20 miles away. There have also been felt earthquakes in the Socorro area, including a widely felt magnitude 2.9 event on May 22, 2007.

Our geodetic and broadband seismic monitoring has continued during 2006-2007. The GPS and broadband seismic site adjacent to the long-established CAR station site east of Socorro has been recording data since 2004. Collaborations with Los Alamos National Laboratory (LANL) allowed us to temporarily deploy two new broadband seismometers north of Socorro, co-located with two new continuous GPS stations, to explore uplift and seismicity associated with the Socorro magma body. For more network information, see *www.ees.nmt.edu/Geop/NM_Seismology*. Current research efforts include relocation of small earthquake swarms in the Socorro magma body region.

Studies at the surface around the uplift above the Socorro magma body continued. These efforts included basic geologic mapping, installation of two new continuous GPS stations, and a small network of tiltmeters, and previous sets of campaign GPS measurements being compiled by researchers and students at New Mexico Bureau of Geology and Mineral Resources and Department of Earth and Environmental Science, New Mexico Institute of Mining and Technology (NMT), and at Georgia Institute of Technology.

Following the successful earthquake catalogs compiled by Al Sanford and colleagues (2002), the Geophysics group at NMT has completed an earthquake catalog through 2004. Data from the catalogs may be downloaded from *http://geoinfo.nmt.edu/publications/earthcat*, and this catalog was published in *New Mexico Geology* in the November 2006 issue (Sanford and others, 2006).

Ongoing research projects using seismology to image the lower crust and upper mantle in New Mexico and adjoining regions of the southwest include Colorado Plateau/ Rio Grande Rift Seismic Transects Experiment (LA RISTRA), a teleseismic Incorporated Research Institutions for Seismology (IRIS) Program for the Array Seismic Studies of the Continental Lithosphere (PASSCAL)-supported experiment along a great-circle transect spanning west Texas, New Mexico, Arizona, and Utah (see *www.ees.nmt.edu/Geop/Ristra/ristra.html*). Recent funding from Los Alamos Institute of Geophysics and Planetary Physics (IGPP) has supported an extension (RISTRA 1.5) of the original 1999-2001 RISTRA deployment that incorporated an additional 18 stations and extends the experiment across the Colorado Plateau and into the Great Basin. A newly funded National Science Foundation (NSF) Continental Dynamics and LANL-funded project in which NMT is a major partner, CREST (Colorado Rockies

Experiment and Seismic Transects; *www.ees.nmt.edu/Geop/CREST*), has completed its siting phase (summer of 2007), and will expand knowledge of the Rocky Mountains regional lithosphere, including addressing the question of the high elevation of the central Rockies and the nature of the Colorado mineral belt and possibly related Four Corners region mantle anomalies noted in RISTRA. CREST will be coordinated in 2007-2011 in association with EarthScope seismic and other instrument deployments and the first PASSCAL stations (of 60) will be installed in the summer of 2008.

With the funding of EarthScope in the NSF Major Research Equipment and Facilities Construction account in Fiscal Year 2004, the IRIS Consortium and NMT have completed the construction and staffing of the USArray Array Operations Facility (AOF). The AOF is co-sited with the IRIS PASSCAL portable seismology instrument center and the combined facility has a total professional seismology/geophysics support staff of over 35. As of 10/07, the AOF has completed the first USArray "footprint" and began removing stations from the western edge of the deployment for reinstallation in Montana, Wyoming, Colorado, and New Mexico (see: *http://anf.ucsd.edu/stations.php*).

Paleoseismic studies

According to Dr. Jamie Gardner, the LANL's Seismic Hazards Program has focused on two main activities for the past several years. The first is identifying faults with respect to siting new facilities. The second has been some new geochronological work coupled with an extensive, detailed re-evaluation of all the paleoseismic data for the Pajarito fault system. These paleoseismic studies on the Pajarito fault system lead to a good understanding of the relatively recent earthquake history. Significantly, surface rupturing earthquakes have occurred 1.4-2.2 ka, 4.2-6.5 ka, 9.0-10.9 ka, and 39 ka ago. The event record prior to about 40 ka is not well constrained, but it appears that the Pajarito fault system is in a Holocene cluster of earthquakes. With these new data the probabilistic seismic hazard for Los Alamos National Laboratory has been recalculated, resulting in about a 50% increase in probabilistic ground motion at a 2500 year return period. There is no reason to expect these relations are unique in the Rio Grande rift.

Ruleman and Machette (2007) described the Sangre de Cristo Fault system in northern New Mexico and southern Colorado along the eastern margin of the Rio Grande rift, and led a field trip to look at the fault system (Ruleman and others, 2007). They conclude that short-term and long-term slip rates along the fault can be very different. "During shorter periods of time (<200,000 years) stress is transferred from one zone to another, reducing the seismic hazard along one and increasing it along another" (Ruleman and others, 2007, p. C-130).

Seismology-related publications and abstracts, including the important earthquake catalog above are as follows:

Machette, M.N., Coates, M.M., and Johnson, M.L., 2007, 2007 Rocky Mountain Section Friends of the Pleistocene Field Trip--Quaternary geology of the San Luis Basin of Colorado and New Mexico: U.S. Geological Survey, Open-file Report 2007-1193, 197 p.

Morton, J.J., Bilek, S.L., Aster, R., and Rowe, C.A., 2007, Waveform cross-correlation of earthquake clusters to determine loci of active processes within the Socorro Seismic Anomaly, New Mexico [abstract]: New Mexico Geology, v. 29, No. 2, p. 61.

Olig, S., Zachariasen, J. Wong, I.G., and Dober, M.C., 2007, Paleoseismic evidence for longer and more complex rupture patterns on the Hubbell Spring fault system, Rio Grande rift, New Mexico: Implications for recurrence models and their use in hazard analysis [abstract]: Seismological Research Letters, v. 78, No. 2, p. 315.

Ruleman, C., and Machette, M., 2007, An Overview of the Sangre de Cristo Fault system and new insights to interactions between Quaternary faults in the northern Rio Grande rift, Chapter J in Machette, M.N., Coates, M.M., and Johnson, M.L., 2007 Rocky Mountain Section Friends of the Pleistocene Field

Trip--Quaternary geology of the San Luis Basin of Colorado and New Mexico: U.S. Geological Survey, Open-file Report 2007-1193, p. 187-197.

Ruleman, C., Shroba, R., and Thompson, R., 2007, Chapter C--Field Trip Day 3, Quaternary geology of Sunshine Valley and associated neotectonics along the Latir Peaks section of the Sangre de Cristo Fault zone, in Machette, M.N., Coates, M.M., and Johnson, M.L., 2007 Rocky Mountain Section Friends of the Pleistocene Field Trip--Quaternary geology of the San Luis Basin of Colorado and New Mexico: U.S. Geological Survey, Open-file Report 2007-1193, p. 111-133.

Sanford, A.R., Mayeau, T.M., Schlue, J.W., Aster, R.C., and Jaksha, L.H., 2006, Earthquake catalogs for New Mexico and bordering areas II: 1999-2004: New Mexico Geology, v. 28, No. 4, p. 99-109.

Stankova, J., Bilek, S.L., Rowe. C., Aster, R., 2007, Characterization of the October 2005 microearthquake swarm in the Socorro region, New Mexico, Bulletin of the Seismological Society of America, in press, 2007.

Wilson, D., Sine, S., Grand, S., Aster, R., Ni, J., 2006, Colorado Plateau crust and upper mantle structure: Implications for uplift mechanisms, Eos Trans. AGU, in press, 2006.

Submitted by Susan Bilek, Richard Aster, and Dave Love, New Mexico Institute of Mining and Technology, Bureau of Geology and Mineral Resources, Department of Earth and Environmental Science and Jamie Gardner, Earth Environmental Sciences Division, Los Alamos National Laboratory

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

Earthquake programs in Nevada are interconnected among state and local agencies through the Nevada Earthquake Safety Council. The lead agencies are the Nevada Division of Emergency Management (*www.dem.state.nv.us)*, the Nevada Bureau of Mines and Geology (*www.nbmg.unr.edu*), and the Nevada Seismological Laboratory (*www.seismo.unr.edu*). The Council facilitates public input, develops consensus about seismic issues within public and private sectors, and is the public advisory body for state seismic policy. Minutes of the Council's quarterly meetings and related documents are posted at *www.nbmg.unr.edu/nesc/index.html*.

The 2006-2007 year was an eventful one for Nevada with a successful joint meeting with the Utah Seismic Safety Commission and the Nevada Earthquake Safety Council in St. George, Utah and the Western States Seismic Policy Council annual meeting, in conjunction with the annual meeting of the International Code Council, in Reno, Nevada. Utah and Nevada both have large rural and frontier areas exposed to earthquake hazards and would like to know what the most effective ways are to prepare these areas for earthquakes and how to respond to a disaster in rural areas; thus, the states are jointly promoting putting together a Rural Earthquake Disaster Summit. At the WSSPC meeting, one of the sessions included marketing and risk communication experts discussing ways to improve the earthquake safety, preparedness, and mitigation messages for the public. Hopefully this session will help reinvigorate efforts to motivate people to be prepared for earthquakes.

The updated Nevada State Hazard Mitigation Plan has received approval from the Federal Emergency Management Agency and includes 10 earthquake-related action items:

1. Retrofit and mitigate shaking hazards in Nevada emergency facilities.
2. Create Planning Special Consideration Zones for Nevada communities to avoid building over faults.
3. Create a Nevada earthquake Internet site.
4. Insert "Living with Earthquakes in Nevada" into Nevada newspapers.
5. Develop detailed earthquake disaster planning scenarios.
6. Successfully recover from an earthquake disaster.
7. Teach Nevada teachers about earthquake safety in workshops and classes and through curricula.
8. Inventory and retrofit seismically dangerous buildings.
9. Develop live and Internet-based workshops for professionals and citizens on building with seismic resistance, seismic retrofit methodologies, nonstructural hazard mitigation, and earthquake geology for geotechnical professionals.
10. Identify and characterize earthquake hazards in Nevada, including microzonation of urban areas.

The statewide emergency management assistance compact (EMAC) has been ratified, although it is undergoing revision. This compact allows for funds to be recovered after mutual assistance has been given between counties and/or incorporated cities during a disastrous event.

In November 2007 the Nevada Working Group on Quaternary Faults was convened at the University of Nevada, Reno. The 23-member Working Group reviewed 11 of the highest risk faults in Nevada and made recommendations for future research.

Submitted by Craig dePolo, Research Geologist, Nevada Bureau of Mines and Geology, Jonathan Price, Director and State Geologist, Nevada Bureau of Mines and Geology, and Rick Martin, Program Supervisor, Nevada Division of Emergency Management

Oregon Department of Geology and Mineral Industries
Oregon Seismic Safety Policy Advisory Commission
and Oregon Emergency Management

Earthquake Program

OSSPAC was informally requested by OEM Director Ken Murphy to assist OEM in exploring the issues involved in forming the Seismic Grants Committee and deliberating the criteria for the Grant application and its process. Jim Doane stepped down as the OSSPAC chair. The new Chair, Gerry Williams, created two additional committees: one to tackle issues for the Grants program and another for developing a two-year Strategic Plan. OSSPAC will continue to receive testimony from key public and private stakeholders, such as utilities and state agencies, on their risk reduction measures and earthquake response plans.

As directed by SB-2 (2005), DOGAMI completed its statewide seismic needs assessment, which is a comprehensive and original database of about 3,350 public schools and emergency facilities (see *www.oregongeology.com/sub/projects/rvs/* to download some or all of the report or associated materials). Forty percent of all buildings were assessed a high or very high probability of collapse risk (RVS score less than or equal to 1.0). Oregon Seismic Rehabilitation Grants Program received funding for OEM staffing through Senate President Courtney's SB-1 (2007) that funds the hiring of a Grant Program Manager and an Administrative Assistant.

FEMA Pre-Disaster Mitigation (PDM) 2007 Grants were awarded to the City of Salem for seismic upgrades to fire stations and the City of Albany received 2006 funding for retrofitting a water treatment facility. Demonstration tours of two university seismic mitigation projects, which are funded by PDM 2005, received high visibility. Reports on three university demonstration projects, which were funded by PDM 2003, were published by DOGAMI.

OEM and DOGAMI sponsored Benefit/Cost Analysis training sessions with emphasis placed on seismic projects and attendance by OSSPAC members. DOGAMI sponsored a seismic hazard workshop for the Oregon Department of Transportation and has made seismic design recommendations on critical infrastructure.

The enhanced rapid visual screening (E-RVS) method was developed by DOGAMI with funding support from the Oregon University System. FEMA and Applied Technology Council are evaluating the method for possible adoption.

The six Region 3 counties (Benton, Lane, Linn, Marion, Yamhill and Polk), which were funded by FEMA PDM 2003, have updated hazard maps and HAZUS results from DOGAMI and FEMA-approved natural hazard mitigation plans. Many other counties/cities received or are in the process of receiving FEMA-approved plans.

Oregon has continued to participate in the Cascadia Regional Earthquake Workgroup (CREW). Yumei Wang was elected as a new Board Member. OEM has continued to support the Recovery Planning initiative led by the Oregon Partnership for Disaster Resilience. OEM has also participated in the program planning for the 2008 National Earthquake Conference in Seattle.

OEM and DOGAMI representatives attended the WSSPC Annual Conference with representation from OSSPAC by Tom Manning and Sue Graves, from the Lincoln County School District, who won a 2007 WSSPC Award in Excellence in Outreach.

Yumei Wang was appointed as a member of the Advisory Committee on Earthquake Hazards Reduction.

OEM and DOGAMI representatives attended the National Earthquake Prediction Evaluation Council meeting in Portland on understanding the "slow earthquake" or episodic tremors along the Cascadia Subduction Zone.

Jay Wilson attended the 2007 National Earthquake Program Managers meeting held in Pigeon Forge, Tennessee.

Tsunami Program

As part of the National Tsunami Hazard Mitigation Program (NTHMP), DOGAMI is working with Oregon State University and Oregon Health and Sciences University on continuing development of updated tsunami inundation modeling, paleotsunami deposit mapping and tsunami inundation hazard assessment for the Oregon coast, beginning with a pilot project at Cannon Beach. These hazard maps are being developed with new geologic source models of the Cascadia Subduction Zone fault rupture to better estimate the various tsunami inundation hazards and the recommended evacuation zones.

Oregon continues to support the TsunamiReady™ Community Program with Douglas County being recognized this year and three-year reviews conducted in Cannon Beach and the Northern Tillamook County Communities of Manzanita, Nehalem, and Wheeler.

Lincoln City was chosen as a demonstration project for using neighborhood-based groups such as Community Emergency Response Teams (CERT) to improve the tsunami readiness of the "community" and enhance the benefits of an existing TsunamiReady™ Community. Working with the National Weather Service, OEM and DOGAMI will provide support to Lincoln City in their employing a tsunami preparedness coordinator to spearhead this enhancement of public outreach and nurture sustainable grassroots disaster preparedness.

Jay Wilson participated in a multi-agency TsunamiReady™ Summit held in San Diego to evaluate the program and suggest recommendations for improving voluntary participation and delivery of benefits.

OEM and DOGAMI participated in the NTHMP 5-year review, with Jay Wilson participating in the committee for designing the review and selection of the panel. OEM has continued compilation of interviews and observations for the 1964 Alaska tele-tsunami for the educational video documentary. Jay Wilson participated in the NTHMP Tsunami Warning Subcommittee and worked with West Coast/Alaska Tsunami Warning Center to review and revise the tsunami warning and advisory criteria to address issues raised by the impacts of the Kuril Island tsunami events at Crescent City, California.

Based on the Washington Emergency Management Division design, OEM and DOGAMI, with assistance from the National Weather Service Offices in Portland and Medford, developed an Oregon Tsunami Emergency Media Guide as an outreach resource tool for news agencies to reference during tsunami events. The binder was introduced at the Oregon Association of Broadcasters Annual Conference in September 2007 and will be officially released in conjunction with the National Weather Service's revised definition for a Tsunami Advisory in February 2008.

Both agencies met with Oregon Coastal Fire Chiefs' All Hazards Task Force in February and July 20, 2007 to present updates on tsunami-related program and policy issues.

Jay Wilson moderated a session on Cannon Beach's tsunami recovery planning workshop during the NOAA Coastal Zone 07 Conference.

Submitted by Jay Wilson, Earthquake and Tsunami Program Coordinator, Oregon Emergency Management

Utah Geological Survey

The Utah Geological Survey (UGS) and U.S. Geological Survey (USGS) conducted a cooperative paleoseismic study of the Weber segment of the Wasatch fault zone. We excavated trenches on the northern part of the segment in May 2007; the final report is in preparation. The UGS and USGS will again cooperate in 2008 on a trenching study of the Brigham City segment to assess timing of the most recent event. The UGS completed a Quaternary geologic map of the southern segments of the Wasatch fault (Levan and Fayette segments), and an evaluation of displacement-per-event data from paleoseismic studies on the central segments of the Wasatch fault. A non-trenching paleoseismic evaluation is also underway for the Washington fault in southern Utah. The UGS provided comments to the USGS National Seismic Hazards Mapping (NSHM) Project on the 2007 NSHM update, and provided data to the USGS to help locate sites to perform micro-tremor studies along the Wasatch Front in summer 2007.

The UGS, USGS, and Utah Seismic Safety Commission (USSC) held the 2007 meetings of the Utah Ground Shaking, Quaternary Fault Parameters, and Liquefaction Working Groups in February 2007. Each working group heard results of completed and ongoing studies, and set priorities for 2008 work. In support of the ongoing studies, the UGS updated the Quaternary fault-and-fold, shear-wave-velocity, deep-basin-structure, and landslide shear-strength databases. The Wasatch Front community velocity model was updated to reflect new intermediate to deep shear-wave-velocity profiles, and planning is underway to prepare detailed urban seismic hazard maps for the Wasatch Front by the USGS, UGS, and other working-group partners.

The UGS completed work with Utah State University (USU) to prepare a site-conditions map for the Wasatch Front using USU's additional shear-wave-velocity data collected in 2005 for areas outside Salt Lake County. The final earthquake site-conditions map for Salt Lake County is nearly complete and scheduled for publication by the UGS in 2008. The UGS will continue working with the University of Utah and Brigham Young University in 2008 to finish liquefaction-induced ground-displacement maps for Salt Lake Valley using the updated 2007 NSHMs and collect data to produce similar maps for Utah Valley.

The UGS, University of Utah Seismograph Stations, Utah Division of Homeland Security, and Structural Engineers Association of Utah are cooperating with the USGS to prepare a Utah version of the popular California "Putting Down Roots in Earthquake Country" publication for release in mid-2008. The UGS also provides staff for the USSC, which held a joint meeting with the Nevada Earthquake Safety Council in St. George, Utah, on May 10, 2007.

Submitted by Gary E. Christenson, Geologic Manager, Utah Geological Survey, and William R. Lund, Senior Scientist, Utah Geological Survey

Utah Division of Homeland Security

The Utah Earthquake Program is comprised of four agencies, the Utah Geological Survey, the University of Utah Seismograph Stations, the Utah Seismic Safety Commission, and the Utah Division of Homeland Security. All of these agencies have important roles in protecting and preparing the state.

The Utah Seismic Safety Commission (USSC) is continuing work on its Unreinforced Masonry (URM) Initiative and has joined forces with the Structural Engineers Association of Utah. This initiative will have several parts. The Commission has drafted a resolution to be presented to state legislature that states that URM's are a problem building type and the state needs to further study their impact to the economy and life safety. The Commission has approached the legislature in an effort to secure funding to characterize the URM building problem in the state. This characterization would be accomplished by conducting a statewide survey to estimate the number of URM buildings and provide those findings to the state legislature. Incentives programs will be developed to encourage seismic retrofits and provide some financial support from the local and state levels.

The USSC is supporting an initiative from the Utah State Office of Education (USOE) that all K-12 schools have an ATC-21 evaluation completed by a professional engineer or architect. USOE requested funding from the legislature last year to start a rehabilitation program for older school buildings statewide. The funding bill did not pass, but USOE will request funding again in the 2008 legislative session.

In May 2007, the USSC conducted a joint quarterly meeting with the Nevada Earthquake Safety Council in St. George, Utah. The purpose of the meeting was to bring the two advisory groups together to familiarize themselves with each organization's activities and to find common ground. Both states share common problems and successes and can build consensus on common issues found in each state.

The USSC has completed its latest progress report. This periodic report is required by statute and will be presented to the state legislature to report on the past few years of activities by the Commission.

The University of Utah Seismograph Stations (UUSS) received $1.4 million of one-time and permanent funding from the legislature to expand its network in the southwestern part of the state. This part of the state has had significant population increases in the past few years. Other areas of the state that will get new instrumentation are central and eastern Utah. The additional seismographs will enable the UUSS to generate ShakeMap statewide.

The UUSS traveling earthquake display, which provides schools with information about earthquakes throughout the intermountain west and Utah, continues to be very popular. The two displays are continually booked throughout the school year. Funding for the display is provided by the Utah Division of Homeland Security.

The UUSS commemorated the centennial of the installation of the first seismographs on the University of Utah campus on June 29, 1907 and celebrated 100 years of recording earthquakes in Utah. A program was held on June 29, 2007 at the University of Utah with the Lt. Governor, relatives of Dr. James E. Talmage who installed, monitored, and maintained the first seismograph, and Dr. Walter Arabasz presenting remarks for the gathering.

UGS, UUSS, USSC, and the Utah Division of Homeland Security (UDHS) along with a FEMA contractor formed a committee to develop products that could be made available to emergency managers, first responders, government jurisdictions, and the private sector after an earthquake. Using ShakeMap and HAZUS, a suite of maps will be generated in the first hours after an earthquake that will provide much needed information about the earthquake. The committee will also develop a way to push this information out to the requesting agencies. For pre-disaster planning, an earthquake scenario has been developed for the greater Salt Lake Metropolitan area. This scenario has been used in the development of several earthquake exercises of the past few years.

UDHS is part of a safety committee with the Utah State Office of Education (USOE) that revised the USOE's "School Emergency Plan Guide". A safety conference for schools was the venue for unveiling of the new plan guidance as well as providing breakout sessions on issues affecting school safety.

UDHS continues to develop projects for the Pre-Disaster Mitigation Grant program. Seismic projects to date include retrofit of four fire stations, multiple-phase retrofit of a major water conservancy complex, and the Marriott Library on the campus of the University of Utah.
A committee consisting of the four state earthquake programs along with the Structural Engineers Association of Utah has been working on an earthquake information booklet. With assistance from the U.S. Geological Survey (USGS), this multi-page booklet will provide information about earthquake-related geologic hazards, the monitoring of earthquakes in the state, how the buildings perform in an earthquake, and how to plan and prepare for an earthquake. The booklet is being patterned after the USGS "Putting down Roots" booklet that has been successfully used in California.

Submitted by Robert Carey, Earthquake Program Manager, Utah Division of Homeland Security

Washington State Military Department, Emergency Management Division (EMD) and Washington State Department of Natural Resources, Division of Geology & Earth Resources (WDGER)

Washington State continued to focus on reducing the impact of earthquakes and other geologic hazards through public education efforts and by providing the necessary tools for communities to become more disaster resistant. Examples of the Program's activities include the following accomplishments in Federal Fiscal Year 2007:

- April was designated "Washington State Disaster Preparedness Month". Educational materials were distributed to local jurisdictions, state agencies, schools, businesses, and the general public. A statewide earthquake "Drop, Cover and Hold" drill was also conducted.

- May was designated "Volcano Awareness Month". In partnership with the U.S. Geological Survey (USGS), EMD distributed volcano materials and publications to local jurisdictions, state agencies, schools, businesses, and the general public.

- September was designated "National Preparedness Month":
  - Materials were developed to support the month's activities: Drop, Cover & Hold Drill, StormReady® Day, NOAA Weather Radio Month, and 9-1-1 Day.
  - Materials were distributed to citizens via the website and were translated into alternate languages. Materials included information on the Earthquake "Drop, Cover, and Hold" (DCH) drill, carbon monoxide poisoning, generator safety, and preparedness for weather events.
  - Conducted Tsunami and Earthquake Emergency Alert System State test and statewide DCH Drill.

- EMD's community-based public education Map Your Neighborhood (MYN), originally developed for earthquake recovery, empowers people to prepare for emergencies and shows them how to organize their neighborhoods, so they will be better able to care for each other after a disaster.

- EMD continued to partner with Federal Signal to design and develop the AHAB (All Hazard Alert Broadcast) Radio System that provides both tone and voice alert notification to at-risk communities for any hazardous situation.
  - Coastal tsunami warning infrastructure continued to be developed along the coast of Washington. A total of 30 AHAB Radios have been placed in high population areas along the coast. These systems are satellite based controlled and can be activated from the EMD Alert and Warning Center as well as by the local jurisdiction. The 6 that were previously installed on the coast were upgraded to be satellite based controlled as well.

- EMD partnered with Pierce County and supported the acquisition of equipment to expand the coverage of an AM emergency radio transmission capability for the Puyallup Valley that allows emergency personnel an additional tool to notify citizens of a natural or man-made disaster event.

- The 2007 legislative session made an appropriation to the Washington Division of Geology and Earth Resources (WDGER) to map earthquake-induced ground failure hazards in tsunami hazard areas to assist local jurisdictions in creating effective tsunami evacuation and response plans.

- WDGER published OFR 2007-1, "Field data for a trench on the Canyon River fault, southeast Olympic Mountains, Washington," by T. J. Walsh and R. L. Logan, and OFR 2007-2 "The Darrington–Devils Mountain fault—A probably active reverse-oblique-slip fault zone in Skagit and Island Counties, Washington," by J. D. Dragovich and B. W. Stanton. WDGER also published a seismic design category map for the 2006 International Residential Code and characterized the shear

wave velocity structure for four sites of the Advanced National Seismic System (ANSS) in Washington in OFR 2007-4 "Seismic Design Category Maps for Residential Construction in Washington," by Recep CaKir and T.J. Walsh. WDGER also developed and produced tsunami evacuation brochures for Point Roberts, Bellingham, Sandy Point, the Lummi Nation Reservation, and the Hoh Tribe Reservation. The maps will be used to develop an earthquake/tsunami risk communications program for citizens and visitors.

- EMD continues to partner with the University of Washington, Pacific Northwest Seismograph Network (PNSN) to develop information products, improve communications and collaborate in planning and providing educational outreach activities.
  - This year the PNSN received USGS funding to purchase and program 14 computer systems with the CISN Display and other information products. EMD hosted two workshops for emergency managers and first responders from coastal communities and Native American Tribes from the Washington coast and Puget Sound Region. Tribal and community representatives were provided an overview of the earthquake and tsunami hazards of the region and how to access the information products produced by the PNSN. Each participating organization was then provided with a computer system for their emergency operations center.
  - Other EMD/PNSN collaborations include development of a higher resolution Seattle area Shake Map, EMD employment of Shake Cast at the State Emergency Operations Center (EOC), and partnering with the PNSN and USGS to conduct the well attended Eastern Washington Earthquake Workshop October 2007.
  - Both agencies are active participants in the Cascadian Region Earthquake Workgroup (CREW) and are contributing to the planning of the 2008 National Earthquake Conference.

- National/International Outreach:
  - Supported the development of processes and protocols for Puerto Rico's first All-Hazard Alert Broadcasting (AHAB) Radio Puerto Rico. Meetings were held with state emergency management and emergency managers from Western and Eastern Puerto Rico to discuss the Washington Tsunami Warning Protocol, the AHAB Radio and the process used for installation.
  - Instructed Course 3: Tsunami Mitigation, Preparedness, Response and Recovery at the University of Washington (UW) as part of a certificate program in Tsunami Science and Preparedness. The certificate program is a NOAA/UW partnership to educate at-risk tsunami communities world-wide. The first class included participants from India, Indonesia, Thailand, Maldives and Sri Lanka. EMD coordinated a town hall meeting with Aberdeen officials for this group to listen to various tsunami preparedness talks regarding this risk and vulnerability and what they can do to prepare their community for a tsunami strike and provided first hand experience to the audience on the impact the 2004 Indian Ocean Tsunami had on their communities. This group also visited EMD and were given a tour of the EOC and then provided a briefing on Washington's Tsunami Warning Procedures.

- A delegation from Sri Lanka spent the day at EMD to discuss comprehensive emergency management planning; EOC operations and planning; tsunami warning protocols; how to conduct a tsunami simulation exercise; and an end-to-end communications test.

- Participated in the Tsunami Alert Rapid Notification System Workshop – Tsunami Warning Simulation Exercises as a keynote speaker and presented a case study on Community Evacuation Exercise – Quileute Tribe, and a Washington State case study on tsunami preparedness through simulation exercises.

- Hosted a camera crew from London, England preparing a National Geographic documentary on tsunamis. They filmed the State EOC and a tsunami simulation exercise. Viola Riebe from the Hoh Tribe, who is the storyteller from our tribal video "Run to High Ground," was also interviewed as part of the documentary.

- Briefed Thailand Security Council on Washington State's Tsunami Program and Warning System. This briefing has led to a dialogue between EMD and National Disaster Warning Center Thailand. EMD is developing a proposed joint tsunami exercise to be held in 2008.

- Exercises, Drills, Conferences and Workshops:
  - Attended the Western States Seismic Policy Council conference and gave a briefing on a Cascadian Subduction Zone Scenario identifying impacts of such an earthquake to the Pacific Northwest and offered solutions to reduce its impact.
  - Participated in the 2007 Missouri State Emergency Management Agency Conference in Branson, Missouri. Presented two sessions on seismic events and how to prepare, educate and mitigate them and used best practices from the Washington Earthquake, Tsunami and Volcano Programs to spur state and local involvement in the development of preparedness and mitigation processes.
  - Participated in the Grays Harbor County functional exercise that was based on a Cascadian event.
  - Participated in the Jefferson County table top exercise and briefed the participants on the tsunami warning process in Washington. Helped guide the exercise discussion that was based on a distant tsunami event.

- EMD continued to partner with the Institute of Geological and Nuclear Sciences on assessing education and preparedness of our citizens:
  - Continued the work underway assessing school education programs around Mount Rainier. The goal was to document the current level of awareness and perceptions of hazards; assess discrepancies between fact and perceptions; and, document the effectiveness of current educational programs.
  - Conducted a survey of managers and staff of Long Beach hotels/motels to assess their understanding of tsunami risk, planning issues and levels of staff training. Reviewed changes in preparedness in Ocean Shore's hotels/motels following last year's study and evaluated education material and training provided.
  - Assessed school education in coastal communities of Grays Harbor and Pacific Counties and achieved the same goals as those stated in the program for students around Mount Rainier noted above.

- Represented the National Emergency Management Association (NEMA) at an ANSS Steering Committee meeting. 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. The committee also made recommendations on funding, distribution of seismic equipment, and research projects needed to support ANSS program goals and objectives.

- Served on the 3rd phase of developing guidelines for tsunami structures in areas of strong ground shaking as an ATC-64 Project Review Panel participant. This guidance is due to be released in early 2008. This group provided guidance and feedback to the Applied Technology Council who is FEMA's contractor for this project.

Submitted by Timothy J. Walsh, Chief Geologist, Hazards Section, Washington Department of Natural Resources, Division of Geology and Earth Resources and George Crawford, Earthquake Program Manager, Washington Military Department, Emergency Management Division

Wyoming State Geological Survey

In 2007, the Wyoming State Geological Survey began two projects related to earthquake hazards. The first project involves compiling an existing earthquake database into a web format which will enable a user to submit queries based on four attributes: location, magnitude, depth, and intensity. The location query will allow the user to choose either a region bound by coordinates in latitude and longitude or by county. Results from queries will then be available for downloading into GIS data format as well as database format. Once online in spring of 2008, the database will be updated weekly.

Secondly, the Wyoming State Geological Survey is attempting to procure funds from the state of Wyoming to upgrade 10 of the active seismometers and data relay equipment in Yellowstone National Park. These upgrades will greatly increase the availability of the component data coming out of the Park as well as reinforce the data relay infrastructure in the Park.

Submitted by Ron Surdam, Director and State Geologist, Wyoming State Geological Survey