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Hazard-Specific Annex - Earthquake

Approved (November 1, 2010)

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1 Purpose

To describe the potential hazards and identify special considerations or activities specific to responding to and recovering from a seismic event.

2 Situation and Assumption

2.1 Situation

Washington County can experience three types of earthquakes; lower plate, crustal and subduction zone earthquakes.

Since the late 1980's, the residents of Washington County have become increasingly aware that they live in earthquake country and that damaging earthquakes will strike in the future. This growing awareness increased dramatically in 1993 when western Oregon experienced two damaging upper crustal earthquakes, Scotts Mills (magnitude 5.6) and Klamath Falls (magnitudes 5.9 and 6). The last significant earthquake in Oregon, prior to 1993, was in 1962. This earthquake shook the Portland area with a magnitude of 5.2. Next door in Washington State, the Puget Sound area experienced even larger and more damaging intraplate (lower plate) earthquakes in 1949 and 1965 with magnitudes of 7.1 and 6.5, respectively. Most of these earthquakes were felt by residents living in Washington County.

Crustal earthquakes typically occur along active fault lines. There are five faults within Washington County: Tualatin-Sherwood; Oatfield; Costco; Gales Creek; and the 30-mile Portland Hills Fault that are confirmed as active.

Historic record shows that the last subduction zone earthquake affecting Western Oregon occurred approximately 300 years ago and may have been a magnitude 9 or greater, affecting coastlines from British Columbia to Northern California. Japanese historic records indicate that a destructive distantly-produced tsunami struck their coast on January 26, 1700. It is very possible that the subduction zone earthquake, that produced this tsunami, occurred off the Pacific Northwest coast. Indian legends also lend some support to the timing of this last event. This type of earthquake is expected to reoccur at anytime and produce significant damages in Washington County.

Relative Earthquake Hazard Maps (IMS-001 1997 and GMS-104 1996) produced by the State of Oregon Department of Geology and Mineral Industries classifies much of the incorporated areas of Washington County as being Zone A. Relative to other areas, Zone A is likely to sustain the greatest damage during a seismic event.

The Washington County Hazard Analysis rated the earthquake hazard as low in terms of history, moderate in terms of vulnerability and probability, and high in terms of maximum threat. While earthquakes have not been experienced frequently in the county, the maximum threat would have widespread and long-lasting impacts.

Adding to the earthquake hazard within Washington County are a number of other geological conditions that would serve to magnify the degree of shaking and the consequent damages the shaking would create. These conditions include clay/silty sands/loam soils, high water tables, and numerous steep slopes. Saturated granular soils with poor drainage can shift dramatically

during an earthquake, a behavior called liquefaction. Liquefaction can affect the structural integrity of buildings and other structures resulting in heavy damage, condemned structures and possible loss of life. Although recent upgrades in the Oregon Building Codes will reduce the extent of property damage from future earthquakes, any quake that occurs within Washington County, a neighboring county, or at the Cascadia Subduction Zone that generates high Mercalli intensity is expected to cause widespread damage to public and private facilities, mass casualties, and significant disruption of lifeline services.

2.2 Assumptions

In addition to structural damage to bridges, buildings, utilities, and communications systems, any earthquake that generates high Mercalli intensity may be expected to result in:

- Additional natural/environmental emergencies such as landslides;
- Industrial/technological emergencies such as fires, explosions, and hazardous materials incidents;
- Disruption of vital services such as water, sewer, power, gas, transportation (including severe impacts to roads and bridges), communications;
- Damage to, and disruption of, emergency response capabilities (facilities, resources, and systems);
- Emergency management organizations in the region are also impacted and unable to provide mutual aid;
- Loss of businesses and industries, reducing the county's economic base; and
- Significant injuries and loss of life.

Depending on when the earthquake occurs, a large number of county employees may be unable to make it to work or the EOC.

Field units may need to self-initiate responses and work independently until centralized command, control, and communications can be reestablished.

3 Concept of Operations

3.1 Definitions

Aftershock – An earthquake of similar or lesser intensity that follows the main earthquake.

Crustal Earthquake - The uppermost 0-19 miles of the earth's crust is brittle enough to produce crustal earthquakes close to a 7.0 Magnitude event. Aftershocks usually occur.

Fault - A break in the earth's crust which ruptures during an earthquake, allowing the two sides of the fault to slip past each other. The slippage may range from less than an inch to more than 30 feet in a severe earthquake.

Earthquake – Seismic vibrations produced when a fault in the earth’s crust ruptures or breaks, causing movement or slippage of the rocks along the fault.

Liquefaction – A process by which water-saturated sediment temporarily loses strength and acts as a fluid when exposed to strong seismic shaking. The shaking causes the grains to lose grain-to-grain contact, so the sediment tends to flow. Liquefaction is most likely in loose sandy soil with a shallow water table.

Lower Plate Earthquake – Earthquakes that originate at a depth between 28 and 37 miles below the earth’s crustal layer and can produce up to a 7.5 Magnitude event. Such earthquakes typically lack aftershocks.

Magnitude – The amount of energy released during an earthquake. An increase of one full point on a magnitude scale represents about a 3-fold increase in the energy released. Therefore, an earthquake measuring magnitude 6.0 is about 30 times more powerful than one measuring 5.0.

Mercalli Scale - A scale of earthquake intensity based on observed effects and ranging from I (detectable only with instruments) to XII (causing almost total destruction).

Plate Convergence – Earth plates that come together, destroying crust and recycling it back into the interior of the earth as one plate dives under another.

Richter Scale - A logarithmic scale for indicating the magnitude of earthquakes using data from a seismograph: each step represents a magnitude that is about 10 times greater than the preceding step, with 1 indicating a disturbance detectable only by instruments and 7 one that can cause major damage to buildings.

Subduction Zone Earthquake - A subduction zone earthquake occurs where two lithospheric plates come together, one riding over the other. The lithosphere is the outer solid part of the earth, including the crust and uppermost mantle. Subduction zone earthquakes have occurred off of Chile in 1960; a similar quake off Alaska in 1964 measured 9.2, and the 2004 quake that generated the catastrophic Indian Ocean tsunami had a Magnitude of 9.1.

Tsunami - A tsunami is a sea wave of local or distant origin that results from large-scale seafloor displacements associated with large earthquakes.

3.2 General

Most actions and procedures required for response to earthquakes are already covered in the Functional Annexes of this plan.

The initial concerns in the event of an earthquake are:

- Emergency Response, (life safety, property protection, environment protection);
- Situation Assessment and Damage Assessment;
- Continuity of Government; and

- Communications.

Aftershocks may generate additional incidents/emergencies, fatalities, injuries, and unsafe structures.

- Action should be taken to protect people that survived the initial earthquake from damage or loss due to aftershocks.
- Follow-up situation, critical facility, damage, human impact, and building safety assessments may need to be conducted following each aftershock.

3.3 Emergency Response

Emergency response actions are those taken immediately after an earthquake to save lives, alleviate suffering, and prevent further disaster.

The emergency response phase of a major earthquake can last from days to weeks, during which emergency services will be overwhelmed by demand.

One of the most difficult aspects of emergency response after an earthquake will be identifying the specific types and locations of incidents that were caused by the earthquake and prioritizing available resources to respond to them.

The ability to collect information and verify damages will be impacted by limited communication avenues. (See Communications Annex) Phones, both landlines and cells, are not expected to function, potentially limiting sources to:

- Observations from responding EOC and county staff;
- Amateur radio;
- News reports; and
- Damage Assessment Teams (when deployed).

Search and Rescue – The collapse of buildings and other structures as well as landslides can be caused by significant earthquakes. People can become trapped and/or injured as a result. While statistically, most earthquake victims are rescued by untrained, spontaneous volunteers that happen to be nearby, the county has a plan for search and rescue. See the Urban Search and Rescue Annex for specifics of this plan.

Access Control and Re-Entry

- Control of access to areas severely impacted by an earthquake will be accomplished by law enforcement, as resources allow.
- Only those directly involved in emergency response operations will be allowed entry and/or re-entry.
- The Emergency Operations Center (EOC), working with the Policy Group and input from public works, local fire, public health, and law enforcement will determine the

appropriate time to allow evacuees and the general public to re-enter the area that was severely impacted.

Debris Clearance – the identification, removal, and disposal of rubble, landslides, wreckage, and other materials that block or hamper the performance of emergency response functions are a high priority action. Activities and responsibilities include:

- Solid Waste and Recycling, Department of Health and Human Services, manages the county solid waste program which includes franchise management in unincorporated Washington County, coordinating with Metro and franchised haulers for emergency debris collection and disposal and designating emergency drop-off points for debris including areas for separating recyclable materials
- Department of Land Use and Transportation has responsibility for the removal of debris from county rights-of-way.

Specific task and duty assignments associated with these activities and responsibilities are outlined within the Debris Management Functional Annex.

Emergency Public Information – See the Alert and Warning Annex and the Emergency Public Information Annex. Critical areas include:

- Survival tips for people on what to do during and immediately after an earthquake. Pre-scripted public messages have been developed and will be utilized by the Joint Information Center (JIC) to inform the public.
- Warnings and advice on the continuing threat of fire, unsafe areas, building collapse, aftershocks, and other hazards.

Emergency Public Shelters – Details on current plans and agreements are located in the Shelter, Care and Temporary Housing Annex. Content of this annex includes:

- Functional descriptions of emergency shelter and temporary housing options.
- Partnerships and agreements in place to activate and manage emergency shelters and temporary housing.
- List of approved Red Cross emergency shelter sites.

3.4 Situation and Damage Assessments

Concurrent with emergency response activities is the need to gather information to provide an overall situation analysis, and, secondarily, to gather information on damage sustained during the earthquake. (See Damage Assessment Annex)

3.4.1 Situation Assessment

- The ability to obtain an initial situation analysis will depend on resources available and the viability of communications.

- Initial information gathered will focus on identification of situations requiring an emergency response and the condition of critical facilities, including roadways, bridges, and utilities.
 - The most likely sources of information will be on-duty fire, law enforcement, public works personnel as well as limited news reports.
 - As field responders assess their response areas for emergency situations, they will also, to the extent possible, gather information on the overall situation and relay it to their appropriate commanders or control centers. These reports should attempt to provide a general description of the area according to:
 - the nature of damage
 - the severity of damage
 - the extent of damage
 - estimate number of people affected
 - If available, Damage Assessment Teams can be deployed early in an incident to conduct situation assessments prior to starting damage assessments.

3.4.2 Critical Facility Assessments

(See Damage Assessment Annex)

- Immediately after a seismic event, LUT building inspectors, Facility staff, and Housing staff will conduct post-earthquake building evaluations of county facilities.
- These initial evaluations will help identify major problems so that WCCCA and other operational control centers (e.g., EOCs) can prioritize limited resources and direct them to the areas with the greatest need.
- Facility evaluations will be conducted under the benefit of a countywide cooperative agreement, and responsibilities for specific facilities will be pre-assigned to different agencies.
- Facility evaluations can also be conducted by emergency responders, operations crews, and Damage Assessment Teams.

3.4.3 Damage Assessment

(See Damage Assessment Annex)

3.5 Continuity of Government

(See Basic Plan and Department Level Continuity of Operations Plans)

3.6 Short-Term Recovery

As assigned in the Functional Annexes that will be used in conjunction with this Annex.

4 Organization and Assignment of Responsibilities

Duties and responsibilities are as assigned in the Basic Plan and Functional Annexes.

5 Direction, Control, and Coordination

(See Section IV of Basic Plan)

6 Administration, Finance, and Logistics

(See Section V of Basic Plan)

7 Plan Development and Maintenance

(See Section VI of Basic Plan)

8 Authorities and References

(See Section VII of Basic Plan)

7 Tabs

- Tab 1 Earthquake/Seismic Activity Incident Checklist

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Tab 1 - Earthquake/Seismic Activity Incident Checklist

Phase of Activity	Action Items	Supplemental Information
PRE-INCIDENT PHASE	<input type="checkbox"/> Continue to maintain and revise, as needed, applicable response plans pertaining to earthquakes and other seismic activity including the Washington County EOP and supporting procedures and plans.	
	<input type="checkbox"/> Pre-designate evacuation routes and alternate routes for areas vulnerable to earthquakes.	
	<input type="checkbox"/> Conduct pre-incident planning for sheltering and evacuation related to earthquakes.	
	<ul style="list-style-type: none"> - Prepare map(s) and script to be used on local television station(s) for emergency broadcast. Include release instructions. 	
	<ul style="list-style-type: none"> - Prepare radio messaging to be used by local radio stations for emergency broadcast. 	
	<input type="checkbox"/> Have personnel participate in necessary training and exercises, as determined by Washington County Emergency Management.	
	<input type="checkbox"/> Participate in Washington County earthquake preparedness activities, seeking understanding of interactions with participating agencies in an earthquake scenario.	
	<input type="checkbox"/> Ensure that emergency contact lists are updated and establish a pre-event duty roster allowing for 24/7 operational support for the County and City EOCs.	
	<input type="checkbox"/> Ensure that earthquake response equipment and personnel inventories for Washington County are updated. Test and maintain response and communications equipment. Keep a stock of necessary response supplies.	
	<input type="checkbox"/> Inform Washington County Emergency Management of any major developments that could adversely affect response operations (i.e., personnel shortages, loss of firefighting equipment, etc.).	
	<input type="checkbox"/> Keep current with new earthquake risk maps and threat analysis distributed by the Oregon Department of Geology and Mineral Industries (DOGAMI).	
	<input type="checkbox"/> Work with county planning division within LUT and local planning commissions for establishment of appropriate infrastructure protection measures in landslide-prone areas.	
	<ul style="list-style-type: none"> - Implement seismic inspection procedures on a regular basis and incorporate improvements to structures while also updating appropriate mitigation plans. 	
	<input type="checkbox"/> Provide public safety information and educational programs regarding emergency preparedness and response.	

Phase of Activity	Action Items	Supplemental Information
RESPONSE PHASE	<input type="checkbox"/> Activate the Washington County EOP when earthquake and/or seismic incidents pose threats.	
	<input type="checkbox"/> Activate the appropriate EOCs and establish Incident Command. For larger events that cross multiple jurisdictions, establish a Unified Command. Staffing levels vary with the complexity and needs of the response.	
	<input type="checkbox"/> Estimate emergency staffing levels and request personnel support.	
	<input type="checkbox"/> Activate, if needed, the EOC Employee Services Unit to provide support and communications between the EOC responders and their families.	
	<input type="checkbox"/> Ensure that action is taken to protect personnel and emergency equipment from possible damage by earthquake, also being cognizant of aftershocks.	
	<input type="checkbox"/> Develop work assignments for ICS positions (<i>recurring</i>).	<i>ICS Form 203: Organization Assignment List</i>
	<input type="checkbox"/> Notify supporting agencies	
	<ul style="list-style-type: none"> - Identify local, regional, state, and federal agencies/entities that may be able to mobilize resources to support local response efforts and EOC staffing. 	
	<input type="checkbox"/> Determine the type, scope, and extent of the incident (<i>recurring</i>). Verify reports and obtain estimates of the area that may be affected. Obtain status of impacts within the County.	<i>ICS Form 209: Incident Status Summary.</i>
	<ul style="list-style-type: none"> - Notify command staff, support agencies, adjacent jurisdictions, and liaisons of any situational changes. 	
	<input type="checkbox"/> Develop and initiate shift rotation plans, including briefing of replacements during shift changes.	
	<ul style="list-style-type: none"> - Dedicate time during each shift to preparing for shift change briefings. 	<i>ICS Form 201: Incident Briefing and ICS Form 202: Incident Objectives</i>
	<input type="checkbox"/> Confirm or establish communications links among local and county EOCs, other AOCs, and the state ECC. Confirm operable phone numbers and verify functionality of alternate communications resources.	
	<input type="checkbox"/> Ensure that all required notifications have been completed. Consider other local, regional, tribal, state, and federal agencies/entities that may be affected by the incident. Notify them of the status.	<i>Established emergency contact lists maintained at the EOC</i>
	<input type="checkbox"/> Manage and coordinate interagency functions. Providing multi-agency coordination is the primary goal. Assimilate into a Unified Command structure if the scope of the incident so dictates.	
	<input type="checkbox"/> Implement local plans and procedures for earthquake operations. Ensure that copies of all documents are available to response personnel. Implement agency-specific protocols and standard operating procedures.	<i>Local, agency, and facility-specific Standard Operating Procedures</i>

Phase of Activity	Action Items	Supplemental Information
	<input type="checkbox"/> Conduct and obtain current damage reports and determine the affected area (<i>recurring</i>).	
	<input type="checkbox"/> Determine the need to conduct evacuations and sheltering activities (<i>recurring</i>).	
	<input type="checkbox"/> Determine the need for additional resources and request as necessary through appropriate channels (<i>recurring</i>).	
	<input type="checkbox"/> Submit a request for emergency/disaster declaration, as applicable.	<i>Section 1 of the Washington County EOP</i>
	<input type="checkbox"/> Activate mutual aid agreements.* Activation includes placing backup teams on standby and alerting resource suppliers about potential needs as well as current needs. * Exception: In a major event, where demands exceed resources, mutual aid agreements should be secondary to resource distribution to jurisdictions with the greatest need.	
	<input type="checkbox"/> Coordinate resource access, deployment, and storage in the operational area. Resources to coordinate include equipment, personnel, facilities, supplies, procedures, and communications. Track resources as they are dispatched and/or used.	<i>ICS Resource Tracking Forms</i>
	<input type="checkbox"/> Develop plans and procedures for registering mutual aid and other first responders as they arrive on the scene and receive deployment orders.	
	<input type="checkbox"/> Establish a JIC and designate a lead PIO for the County.	
	<input type="checkbox"/> Formulate emergency public information messages and media responses utilizing "one message, many voices" concepts (<i>recurring</i>).	
	- Public information will be reviewed by the Incident Commander or designee. Information will be approved for release by the IC and lead PIO prior to dissemination to the public.	
	<input type="checkbox"/> Record all EOC and individual personnel activities (<i>recurring</i>). All assignments, person(s) responsible, and actions taken should be documented.	<i>ICS Form 214: Unit Log</i>
	<input type="checkbox"/> Record all incoming and outgoing messages (<i>recurring</i>). All messages, and the person sending/receiving them, should be documented.	
	<input type="checkbox"/> Develop and deliver situation reports (<i>recurring</i>). At regular intervals the Planning Section will assemble a situation report.	
	<input type="checkbox"/> Develop and update the IAP (<i>recurring</i>). This document is developed by the Planning Section and approved by the Incident Commander. The IAP should be discussed at regular intervals and modified as the situation changes.	<i>ICS Form 202: Incident Objectives ICS Forms 203, 204, 205, 206,207 and 209, as needed</i>
	<input type="checkbox"/> Implement objectives and tasks outlined in the IAP (<i>recurring</i>).	
	<input type="checkbox"/> Coordinate with private sector partners as needed.	

Phase of Activity	Action Items	Supplemental Information
	<input type="checkbox"/> Coordinate resource needs with Washington County Community Organizations Active in Disaster (WC COAD).	
	<input type="checkbox"/> Ensure that all reports of injuries, deaths, and major equipment damage accrued during response activities are communicated to the IC and/or the Safety Officer.	
RECOVERY PHASE	<input type="checkbox"/> Ensure an orderly demobilization of emergency operations, in accordance with current demobilization plans.	
	<input type="checkbox"/> Once the threat the public safety is eliminated, conduct and/or coordinate cleanup and recovery operations.	
	<input type="checkbox"/> Activate, if necessary, the appropriate recovery strategies, continuity of operations plans, and/or continuity of government plans.	
	<input type="checkbox"/> Release mutual aid resources as soon as possible.	
	<input type="checkbox"/> Conduct a post-event debriefing to identify success stories, opportunities for improvement, and development of the After Action Report/Improvement Plan.	
	<input type="checkbox"/> Deactivate/demobilize EOCs, AOCs, and command posts.	
	<input type="checkbox"/> Correct response deficiencies reflected in the IP.	
	<input type="checkbox"/> Activate, if needed, a Washington County Unmet Needs Committee to identify and provide resources that are still needed by county residents in order to return to their pre-disaster situation.	
	<input type="checkbox"/> Revise any applicable emergency response plans based on the success stories and/or lessons learned during the response.	
<input type="checkbox"/> Submit valuable success stories and/or lessons learned to the Lessons Learned Information Sharing website (www.llis.gov)		