Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Due Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

In this activity, you will assess the ground shaking hazard and potential damage to your home from an earthquake of a certain magnitude.

**NOTE: The information you obtain from this assignment must be incorporated into your Earthquake Hazard and Risk Report in which you describe your personal risk from ground shaking.**

Earthquakes cause the ground surface to move in many different directions. The change of velocity in the ground surface during shaking is called **acceleration**. Buildings (and people) experience acceleration as a force pushing on them. High accelerations are more damaging to buildings than low accelerations and high accelerations lead to higher intensity of damage at a given location. As a result, engineers are very interested in determining the **peak ground acceleration** **(PGA)** probable in a location, so they can design structures to withstand the potential shaking. Acceleration values are reported in % of gravity or (%g).

The USGS has created probabilistic seismic hazard maps for most of the United States. Custom maps can be created at the following website:

USGS, 20012, *2008 NHSMP Hazard Mapping,* Earthquake Hazards Program, <http://earthquake.usgs.gov/hazards/>

The website was used to create the map shown in Figure 2.8.1 on the next page. The map uses color to show hard rock peak ground acceleration with 10% probability of exceedance in 50 years. Examine it and answer the questions that follow.



**30**

**25**

**Figure 2.8.1**. Hard Rock Peak Ground Acceleration with 10% Probability of Exceedance in 50 years.

# Finding Peak Ground Acceleration at Your Location

1. Find the location of your home on the map. The darker lines outline the Puget Sound area, the light green lines indicate county boundaries, and the shading represents potential acceleration values.
2. What area/neighborhood do you live in? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. Mark your location on the map.
4. What is the hard rock peak ground acceleration (PGA) value for where you live? \_\_\_\_\_\_\_\_\_\_\_ % g

The value determined in #1c does not include local effects. It is for people who live on hard rock only. As you know, most of us live on softer soils that amplify seismic shaking. In order to account for the type of soil you live on, you will need to multiply the peak ground acceleration by a factor. Find out what you geologic unit you live on by looking back at Assignment 1.6.

|  |  |
| --- | --- |
| **If the geologic map unit is** | **Multiply the PGA by** |
| M, Qb, Qal, Qw, Af, Afr, G, Rg, Qp, Qyal, Qt, Qom, Qoal | 5 |
| A different unit starting with Q | 3 |
| A unit that starts with T or K | 1 |
| Other | Ask your instructor |

1. What geologic unit do you live on (from Assignment 1.6)?
2. What is the peak ground acceleration with 10% probability of exceedance corrected for the soil conditions at your house? (Multiply the hard rock value by the correct multiplication factor in the table above) \_\_\_\_\_\_\_\_\_\_\_ % g
3. **What does this mean?** (Fill in the blank here:)

There is a 10% probability that within the next 50 years, an earthquake in this state will create shaking that produces ground acceleration exceeding \_\_\_\_\_\_\_ % g in the area where you live.

# Comparing Ground Acceleration to the Mercalli Intensity Scale

Let’s find out what these acceleration values mean to your house in terms of the intensity of shaking and potential damage. Find the Modified Mercalli Intensity Scale (provided in the Week 5 file). This scale (which runs from I to XII in Roman numerals) relates damage done during earthquakes at different levels of ground shaking. It can roughly be equated to ground acceleration values. Examine the table and answer the following questions.

1. What Modified Mercalli scale intensity does the peak ground acceleration determined in #3 equate to? *(Remember, you have just found your hazard in percent of g, and the MMI table may not be in percent of g!)*

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Write the Mercalli scale description of this shaking:

**Potential Damage to Your Home**

Maybe you can find out more about the possible damage to your home by looking for information specific to the type of building you live in. The following website provides information on housing types and potential structure damage based on type.

ABAG (Association of Bay Area Governments), 2003, *Impacts of California Earthquakes on Buildings from Shaken Awake*, Online at: <http://www.abag.org/bayarea/eqmaps/shelpop/bldg.html>

Read the classification

Click on the type of construction that best describes your home.

Read the description provided.

1. Building type of your home: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. Based on the construction of your home, what structural damage is likely to occur to your home as a result of severe earthquake shaking? Does your home contain any of the weaknesses mentioned in the description? If so, which?
3. Examine the graph: *Percent Uninhabitable By Intensity Level*. Estimate the percentage of homes (of your building type) that are likely to be uninhabitable after an earthquake of the intensity you found in question 5:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

# Synthesizing Ground Shaking Information

1. In your Earthquake Hazard and Risk Report, you will be asked to discuss the hazard and risk to you of ground shaking at your home. You now have all the scientific data that you need to make this evaluation. Using the information above, **type** at least two paragraphs that **synthesizes** this information for your report. You should have one paragraph where you define the hazard at your house and at least one other paragraph where you describe your potential risk (damage) from the hazard.

Your response should be typed, double-spaced and written in a clear, grammatically correct format. Your paragraphs should be well structured and smooth—with a topic sentence, for instance.

You will be graded on the accuracy, completeness, and level of detail in your response, as well as the quality of your writing. Of course, the sources that you use must have correctly formatted **citations within the text** (see 5.1 Making citations within the text of your work) and correctly formatted **bibliographies for each source** (see 5.2 How to write bibliographies).

As an example:

*I live in Gig Harbor, Washington. There is a 10% probability that within the next 50 years, an earthquake in this state will create shaking that produces hard-rock ground acceleration exceeding 35% g in the area where I live (USGS, 2006). However, I do not live on hard-rock, I live on Qvt (PNSN, 2001), which will triple the amount of shaking I experience. As a result there is a 10% chance that my residence will experience shaking of 105% of g in the next 50 years.*

*105% of g is severe shaking and corresponds to Mercalli intensity IX. The description for this is “General panic; damage considerable in specially designed structures, well designed frame structures thrown out of plumb. Damage great in substantial buildings, with partial collapse. Buildings shifted off foundations.” While there is only a 10% chance that I will exceed this amount of shaking, the fact that it is so severe is very worrying to me. This is a very high level of destruction, and much more severe than the MMI VI that I experienced in the Nisqually earthquake.*

*I live in a mobile home. As a result, in a MMI IX earthquake there is an 85% chance of my home being uninhabitable (ABAG, 2003). According to the ABAG website, it is likely my home will fall off some or all of its supports and in doing so will cause tilting or the utilities to become disconnected. While I would not be able to live in my home after this, it would likely not collapse and kill me, and I may be able to return after my home is “returned to a foundation, re-leveled and reconnected to utilities.” (ABAG, 2003). Luckily, the natural gas to my home is connected with a flexible connection, so I may not have to reconnect this or deal with the potential explosion from a ruptured gas line.*