

Handout 3.1 Classroom Exercise: Discussion of US Earthquake Hazard and Concept of Risk

Note to Instructor: The instructor should divide the class into teams of two or three and have each team discuss the concept of earthquake hazard. This is a non-graded exercise. **The purpose of this exercise is not to arrive at the “correct answer”**, but mainly to promote active involvement of students and to foster thinking in terms of “hazard” and “risk” and “probability” and to put these concepts, as they relate to earthquakes, into context with other hazard events. Emphasize to the students that they should be able to better answer these questions and form stronger opinions as the course progresses.

The following page is to be handed out to begin the exercise. “Answers” for the instructor are provided on the last page of this handout, although several of the questions are open-ended and have open-end and subjective answers/decisions.

Handout 3.1 Informal Classroom Discussion Exercise: Discussion of US Earthquake Hazard and Concept of Risk

I. Facts

In any given year, the probability of being killed in a motor vehicle crash is 1 in 6,000; of plunging to death in an airplane about 1 in 3.1 million. The probability of being killed by a terrorist is 1 in 1.6 million. The chances of being killed by a shark are 1 in 280 million; the chances of dying of a heart attack caused by clogged arteries are 1 in 384.

The hazard maps are developed for specific levels of predicted ground shaking (large enough to be damaging), namely 2%, 5%, and 10% probability of exceedance in 50 years, the average lifetime for a building. The 2%-50-year probability map is used as the basis for engineering design in most regions in the US. This figure corresponds to a probability of the event occurring in any one year of: 1 in 2,500.

II. Discussion Questions to Consider:

- A.** What level of risk is “acceptable” for the design of constructed facilities and lifelines? How does this level of earthquake probability compare with the risk from other natural disasters (such as damaging floods or) everyday threats such car wrecks and plane crashes?
- B.** Also, more people die each year world-wide from floods (i.e., consider Bangladesh), how does this hazard compare with earthquakes?
- C.** How concerned should we be about the level of earthquake threat given these other threats? How much risk is “acceptable”? What value should be placed on human life? How is risk perceived differently by different people? For instance, not being in control is why people tend to believe that jet travel is inherently riskier than riding in a car, even though we seldom think about the fact that we spend much more time driving than flying.
- D.** With limited funding, where should resources be invested to provide protection from earthquakes? Also, what should our goal be for level of protection? Life safety? Lack of major damage? For instance it is well established that the seismic hazard is highest in California, but most other regions are under significant threat from damaging earthquakes. Should we in the U.S. focus our resources on California in an effort make this highest hazard region “bullet proof” or should we spread resource around to provide minimal protection in all areas?

III. Answers: (for instructor only)

- A.** Floods are more likely to occur in most regions in any given year, but earthquakes occur without warning and affect widespread areas when they occur. Also, unlike floods, earthquakes cannot be controlled directly, but the effects can be mitigated. Floods can be directly controlled in most cases with appropriate flood control measures (dams, levees, etc.).
- B.** More people are likely to die from floods in any given year world-wide, but at least there is warning and more direct mitigation possible. Earthquakes have higher consequences when they occur, but their occurrence is generally less probable.
- C.** These questions have no “correct” answer/decision, but the author’s opinion is that we should be concerned about earthquakes and other hazards in susceptible regions.
- D.** These questions have no “correct” answer/decision, but one important goal might be developing tools to better identify, characterize, and mitigate risks (i.e., reliability and risk analysis) to better optimize limited resources.