

Alaska Earthquake Hazard Inventory & Mitigation Planning Activity

Objectives

In this two-part activity, students/participants first:

- Complete a Hazard Inventory for their city or area of interest in the event of a magnitude 7 or larger earthquake and tsunami.
- Identify what critical structures and infrastructure will be affected.

Then:

- Write a summary statement assessing strengths and vulnerabilities of essential services or infrastructure.
- Propose actions for mitigating vulnerabilities.
- Create an Action Plan to address identified needs.

Part 1: Hazard Inventory

Students/Participants investigate the vulnerability of essential public services (police, fire, hospitals, schools, etc.) and essential infrastructure (major roads, bridges, utilities, etc.) from the effects of a damaging earthquake that can cause liquefaction, ground amplification, and landslides. Tsunami inundation is assessed as well as mobilization of dangerous debris (logs, boats, building materials, etc.). Students/Participants evaluate how the age and construction style of buildings and infrastructure affect their vulnerability. A comprehensive document called Rapid Visual Screening provides additional assessment of critical structures. The investigation also considers access to high ground and to basic survival supplies.

Part 2: increase Community Resilience by Mitigating Hazard Vulnerability

After completing the Hazard Inventory in Part 1, students/participants analyze their findings and consider the implications to their community for selected essential services and infrastructure in the event of a magnitude 7 or larger earthquake and tsunami. Students/participants should address both strengths and weaknesses (areas that need improving) to better survive this significant natural disaster in a written summary statement. Students/Participants next determine positive, achievable steps that will mitigate vulnerabilities and improve the resilience of selected essential services and infrastructures such as relocating a school to a safer area, or seismically retrofitting a roadway, bridge, or water reservoir. Finally, an Action Plan is proposed to meet the need for improvements.

Materials

Student worksheets, Pages SW-1 – 3

Maps (see References on last page):

- Appropriate state and municipal seismic hazard risk maps for selected study areas

Additional Resources:

- Office of emergency services
- City hall
- Phone directories



Seismic Map - Municipality of Anchorage. Map of ground failure susceptibility. [Link to larger map on page 7.](#)

Background for Teacher or Presenter

Hazard Inventory & Mitigation Planning Activity

In this two-part activity, participants will complete a Geophysical Hazard Inventory for their city or area of interest in the event of a magnitude 9 Cascadia Subduction Zone Earthquake and Tsunami and identify what critical structures and infrastructure will be affected. Participants will also propose a process for responding to the potential hazards to create a more earthquake and tsunami resilient community.

Part 1: Complete a Vulnerability Assessment of Essential Services and Infrastructures

Teacher/Presenter Notes:

This activity requires several maps and resources that the teacher/presenter will need to assemble prior to doing the activity. Some of the maps are very detailed and will require introduction, orientation and explanation.

Students will complete the Hazard Inventory worksheet on the following page using maps and resources provided. Working in teams, Students/participants choose 1 – 3 different services, infrastructures or buildings, for study, then combine their findings in the inventory..

Many Alaska cities, towns and villages do not as yet, have official comprehensive seismic hazard maps. However with careful observation and analysis, communities can assess their local setting to determine the seismic hazard information needed to complete the Hazard Inventory for this activity including:

Earthquake-Induced Landslides: Are critical structures located near the top edge or base of steep slopes that could fail and slide during an earthquake?

Ground-Shaking Amplification: Are critical structures located on soft sediments, or fluvial outwash materials from streams, rivers or glaciers that would amplify ground shaking during an earthquake?

Liquefaction: Are critical structures located near water i.e. streams, rivers, lakes, wetlands, bays, inlets or harbors where sediments will liquefy and become unstable causing structures to fail by tipping or sinking?

Tsunami inundation: Are critical structures located in low lying coastal areas or along coastal creeks, rivers or inlets where tsunami inundation could reach far inland.

Part 2: Propose ways to mitigate hazard vulnerability and increase community resilience.

Teacher/Presenter Notes

Encourage students/participants to select the services or infrastructures they are most interested in (from the Hazard Inventory in Part 1) to use in this section.

- a) Working in teams, Students/Participants select at least 5 essential services or infrastructure and write a short summary statement assessing strengths and vulnerabilities including specific examples.
- b) Using the 5 identified services, propose potential actions to mitigate the identified vulnerabilities. Teams then report their findings to the entire group.
- c) As a whole group, Create an Action Plan to address the top identified needs to be addressed by the community. The Teacher/Presenter will want to become familiar with possible answers for the “Who Is Involved and What Happens” portion for the Action Plan section. This is designed to be a brainstorming activity which may require help from the teacher/presenter. The focus is on the process more than specific correct answers.

NGSS Science Standards

- Ecosystems—Interactions, Energy, and Dynamics: MS-LS2-1, HS-LS2-1, MS-LS2-4, HS-LS2-7, HS-LS2-8
- Energy: MS-PS3-1, HS-PS3-2, MS-PS3-5
- Waves and Their Applications in Technologies for Information Transfer: MS-PS4-1, HS-PS4-1, MS-PS4-2, HS-PS4-2, HS-PS4-5
- Earth’s Systems: HS-ESS2-2
- Earth and Human Activity: HS-ESS3-1, MS-ESS3-2
- Engineering Design: MS-ETS1-1, HS-ETS1-1, HS-ETS1-3

Part 1: Hazard Inventory

Complete this worksheet using the maps and resources provided.

The Relative Earthquake Hazard Map uses color to indicate the probability (possibility or likelihood) that a specific hazard will occur. The Tsunami Inundation Map uses color to indicate earthquake magnitude.

	Location Describe an approximate location using street names or landmarks	Vulnerability (high, moderate, low or none)						
		Landslide	Ground Amplification	Liquefaction	Tsunami Inundation	Dangerous Debris	Construction (age, masonry, multi-levels, etc.)	Access to High Ground
Current Location								
Your Home								
Essential Services								
Police								
Fire								
Hospital/Clinic								
City/County Government								
Emergency Ops Center								
Jail								
School								
School								
Banks/\$ Institutions								
Essential Infrastructure								
Communications Networks								
Water/Waste-Water Supply Systems								
Utility Plants								
Bridges								
Harbors/Ports								
Airports								
Main Roads								
Haz Mat Structures								
Large Gathering Areas or Vulnerable Populations								
Hotel/Resort								
Parks								
Beach Access								
Bank								
Nursing Homes, Asst. Living, etc.								
Casino								
Event Center								
Shopping Areas								
Other:								
Other:								

Part 2: Mitigating Hazard Vulnerability to increase Community Resilience

1. **Write a Summary Statement** assessing strengths and vulnerabilities of essential services or infrastructure.
2. **Propose Actions** for mitigating vulnerabilities.
3. **Create an Action Plan** to address identified needs.

1. **Summary Statement:** Using the Hazard Assessment chart developed in Part 1, select at least 5 essential services or infrastructure in your city or area of interest and write a summary statement assessing their strengths and vulnerabilities. Include specific examples.

2. **Mitigation Actions:** Propose potential mitigation actions that could be taken to reduce risk at the 5 essential services or infrastructure you selected. Additional sites may be included.

Site/Facility	Possible Mitigation Actions

3. **Create an Action Plan to address identified needs.** Consider things such as: community information, education, and/or focus groups; forming an Ad Hoc committee; presenting findings to a responsible jurisdiction such as city council, county commission, parks department, school board; feasibility studies; professional consultants, identifying funding mechanisms, implementation & construction, etc.

	Action Plan Steps	Who is Involved and What Happens
1.		
2.		
3.		
4.		
5.		
6.		
7.		

References and Resources

PDF Seismic Map - Municipality of Anchorage

https://www.muni.org/Departments/OCPD/Planning/Planning%20Maps/Anch_Bowl_Seismic_8x11.pdf

Downtown Anchorage Seismic Risk Assessment & Land Use Regulations to Mitigate Seismic Risk

<https://www.muni.org/Departments/OCPD/Planning/Publications/Downtown%20Anchorage%20Seismic%20Risk%20Assessment/Downtown%20Anchorage%20Seismic%20Risk-Full%20Doc.pdf>

Maps Showing Seismic Landslide Hazards in Anchorage, Alaska

https://pubs.usgs.gov/sim/3077/downloads/3077_pamphlet_508.pdf

https://pubs.usgs.gov/sim/3077/downloads/3077_sheet1.pdf

General Earthquake Preparedness for Alaska including how to assess risk

<http://earthquake.alaska.edu/preparedness/home>

Earthquake Preparedness Booklet

http://earthquake.alaska.edu/sites/default/files/are-you-prepared_Nov2016-web.pdf