Summary of An Assessment of Earthquake Induced Ground Accelerations for the Hanford Area

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An Assessment of Earthquake - Induced Ground Acceleration for the Hanford, Washington Area

Summary

Published estimates of 0.25 g and 0.32 g for earthquake-induced ground accelerations for Hanford area. Report concludes 0.32 is the preferred estimate for release scenario calculations.

Introduction

Maximum estimated ground accelerations at a basalt repository, Hanford:

1. 0.25g from Washington Power
2. 0.32g Wight (1978)

0.25g value is for lifetime of an existing nuclear power plant, and therefore, using it for a 10^3 - 10^6 year repository lifetime is questionable. Methodology to obtain value is unclear.

0.32g value is said to be for a few hundred years only, and is possibly not valid for 10^3 - 10^5 years.

Evaluations

Approaches to estimating site accelerations

1. Obtain fault lengths near proposed site. Estimate largest possible event from fault from published fault length/earthquake magnitude relationships. Estimate acceleration from published distance-attentuation curves.

Using Rattlesnake-Wallula lineament (32 miles long. 13 miles from site), an approximate maximum acceleration of 0.30 0.05g is obtained.

Criticisms

A. Questionable to define a lineament as a fault capable of rupturing along its entire length

B. Validity of using fault length/magnitude curves from California quakes for eastern Washington site.

C. Possible inaccuracy of procedures used in developing fault length/magnitude curves.

2. Place largest documented events at the site (depth 2km) and use distance-attentuation curves to estimate surface ground acceleration.

Relationship between seismic activity and tectonic features unknown, therefore, largest historical event could happen at the site.

Get 0.7g and 0.5g estimates respectively using hypocentral depth of 2km, and events of m=7 within 200 miles and m=5 3/4 within 80 miles.

Criticisms

A. Proper hypocentral depth to use in unknown, and greater depths produce lower estimates of surface accelerations.

B. Use of the 200 mile event (Pugent Sound) to model the Hanford region may be tectonically indefensible.

3. Use historical seismicity to construct cumulative recurrence curves. Use curves to predict frequency of earthquake occurrence near site in the distant future.

Curve created for 80 mile radius with data since 1900 for completeness and excluding events marked "instrumental" for consistency. Points for intensities III and IV are below graphed line bacause weak shocks may escape detection. Shortness of historical record possibly explains lack of events with intensities greater than VII.

Within a 10^5 year period, the probabilities of earthquakes with intensities of VIII and greater creating accelerations in excess of 0.25g at the site area are 50% or better.

Conclusion that 0.25g is not a conservative estimate for the region over a period of 10^5 years.

Criticisms

A. Historical seismicity rates should not be taken as predictors of return periods of specific earthquakes.

B. Implicit assumptions open to question
   1. Record is complete for intensities V and greater
   2. Frequency of small events is a reasonable guide to the frequency of large events

Conclusions

Over the next 10^5 years, 0.25g is not a conservative acceleration estimate in the Hanford region. 0.32g may be conservative and 0.5g should be conservative.

Higher estimates based upon unknown relationship between seismicity and tectonics in the Pacific Northwest, especially in eastern Washington. Lower estimates may be possible if reasonable tectonic models can be developed for the area.