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Pprobabilistic seismic hazard assessment in south-west gas fields in Iran

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Extended Abstract

Summary

This paper presents the results of seismic hazard analysis Investigation performed on south-west gas fields in Iran. Hydrocarbon reservoirs are among the most important energy resources in human life and in the industry, and thus, in the economy of every country. Seismic hazard analysis in hydrocarbon fields can be useful for the construction of refineries in hydrocarbon fields. To achieve this goal, in the first step, the historical and instrumental catalogs of earthquakes and faults of the proposed area were prepared. Then, two types of seismic sources, namely linear and area sources, were determined in this study. The maximum magnitude and seismic parameters were calculated for each source and appropriate attenuation relationship was chosen for strong ground motion. The attenuation equations used in this study are Boore & Atkinson. (2008), samervile (2001), Abrahamson and Silva (1997), Campbel and Bozorgnia (2003). The results of the seismic hazard analysis in this study show that peak ground acceleration (PGA) of the proposed area is in the range of very high-risk level. According to the seismic hazard zonation map of Iran (standard 2800), the site is located in a region with high risk and base acceleration of 0.35g that has been estimated to be 0.476g in this study. This difference is due to the existence of the near-site fault (that has the highest impact in the region seismicity according to the investigations conducted in this study) and the difference regulation of standard 2800 by the site-specific analysis.

Introduction

The southwestern region of Iran contains 85% of the country oil reserves. The Zagros orogenic belt in this region is one of the major oil-rich areas that accounts for approximately 12% of the world's oil reserves (Bordenove & Burwood (1990)). Due to the existence of important oil reservoirs in the Zagros mountains, the geology of this region has long been explored by various experts and petroleum geologists in the world. The history of the studies in the region dates back to the last two decades of the nineteenth century. Since then, the geological information of this region of Iran includes large number of geological reports, most of which have remained as internal releases in the oil industry.

The study region is located in the geographical coordinates between 50.5 to 54 degrees east longitude and 27 to 30.5 degrees north latitude. This region includes the cities of Burazjan, Neyriz, Jahrom and the settlements of Bonaroyeh and Pashto. Maps of Jahrum, Shiraz, Oghlid, Ardakan, Kazerun, Khormoj, Behbahan, Bushehr and Bayram have been used to study this region. The radius of this region is about 150 km.

Methodology and Approaches

Probabilistic seismic hazard analysis (PSHA) was first developed by the Cornell in the 1970s to analyze earthquake hazards with the purpose of considering uncertainty at potential earthquake sources, wave propagation paths and site conditions.

The steps involved in the probabilistic risk analysis can be described as follows (for a hypothetical site):

1. Identification of all potential earthquake sources
2. Determination of the probability density function of the site distance from the earthquake source
3. Determination of the probability density function of the magnitude of the earthquake in the area or site
4- Prediction of the results of the intensity of ground motion by using functions that are related to magnitude, distance, and other parameters

5. Combination of uncertainties in the magnitude of the earthquake, location, and intensity of the ground motion by using the total probability theorem
6. Earthquake risk estimation in the area

Results and Conclusions

Since hydrocarbon reserves are among the most important energy resources in human daily life and play important role in the industry and economy of every country, seismic hazard analysis in hydrocarbon fields can be useful for building facilities and refineries in hydrocarbon fields.

Considering special analysis of the study site, we note that the ratio of site acceleration to gravity acceleration is obtained as 0.476, indicating the study region is in the category of zones with very high relative risk. This acceleration is higher than the ratio of the design basis to the acceleration of gravity, which is mentioned in the regulation 2800, for a zone with a high relative risk of 0.35. This difference is due to the presence of a fault near the site. According to the studies conducted in this research, Qir and Firoozabad faults have the shortest distance from the site, and thus, have the greatest effects on the seismicity of the region. Due to the presence of the faults near the site and high seismicity in the region, as well as the importance of building facilities and refineries, it is better to avoid building refineries near the faults. In other words, facilities and refineries should be built in areas away from the faults. For this purpose, in the first stage in this study, geological investigations and identification of active faults in the region are needed. In addition, relevant studies such as seismic paleontology and chronology should be made to estimate the return period of earthquakes. These studies are used for more accurate estimation of seismic risk. These studies are strongly recommended in the region especially by considering Qir and Firoozabad faults.