MEASUREMENTS OF SOIL GAS RADON IN AHWAZ FAULT, IRAN

Bahman ESMAEILI
Senior Engineer,Engineering Department Of Kayson Company, Tehran, Tehran, Iran
bahmanesm@yahoo.com

Mehdi ZARE
Title, Inernational Institude of Earthquake Engineering and Seismology (IIEES), Tehran, Iran
mehdi.zare.iran@gmail.com

Bahram SAMANI
Senior Advisor, Kayson Company, Tehran,Iran, Tehran, Iran
bahramsamani@gmail.com

Keywords: Fault, Radon, Ahwaz

ABSTRACT

Ahwaz City is located on Khoozestan Province, a floodplain, almost flat area on the south western margin of Zagros Mountain Range, well known by giant oil fields. Ahwaz Fault is a reverse type with about 100 km length, northwest to southeast direction and a slope towards northeast. Track detector RAD7 is used in order to determine the changes of Radon gas density in Ahwaz Fault district. Measurement of Radon gas was carried out in two sections in order to find the exact location and trend of Ahwaz Fault. First section was located in southeast of Ahwaz City in Mosharrahat district and the second was located in northwest of the City in Hamidieh Road. The mesurement results, show clear increase or pick on Ahwaz Fault. These graphes indicate the exact loction of Ahwaz Fault in northwest and southeast of Ahwaz City.

INTRODUCTION

Ahwaz City is located in south west of Iran as the centre of Khuzestan Province with about 2 million population. The four main geological phenomenon of this area are: Ahwaz Fault, Ahwaz Anticline, Aghajari Formation and Alluvium Deposits of Quaternary. Karoun, the biggest River of Iran, runs through this city. “Ahwaz Urban Railway Project” was started in 2006 (the EPC Contractor is KAYSON COMPANY) and Ahwaz Fault was an important issue to study for the project. Ahwaz City area is mostly covered by young Quaternary sediments and recognition of exact location of Ahwaz Fault and activity of this structure is a difficalty for this project, so soil gas Radon measurements is used to solve this problem. Track detector RAD7 is used in order to determine the changes of Radon gas density in Ahwaz Fault district. The results shows clear increase for this gas element.

AHWAZ FAULT

Ahwaz Fault is a reverse type with about 100 km length, northwest to southeast direction and a slope towards northeast. The Fault passes through the city centre, parallel with Ahwaz unsymmetrical overturned anticline. The dip of the Northeast flank of the anticline is about 15 degree toward northeast, but the dip of southwest overturned flank is about 75-80 degree toward northeast. Previous studies called this feature,

Ahwaz foreland Fault (Torabi et al.,2004) and other research believed Ahwaz Fault is the forehead fractural structure of Zagros Mountain rang (McQuarrie N. 2004). The recently published Active Fault Map of Iran addresses the Ahwaz Fault as active type, which is supported by several earthquakes.

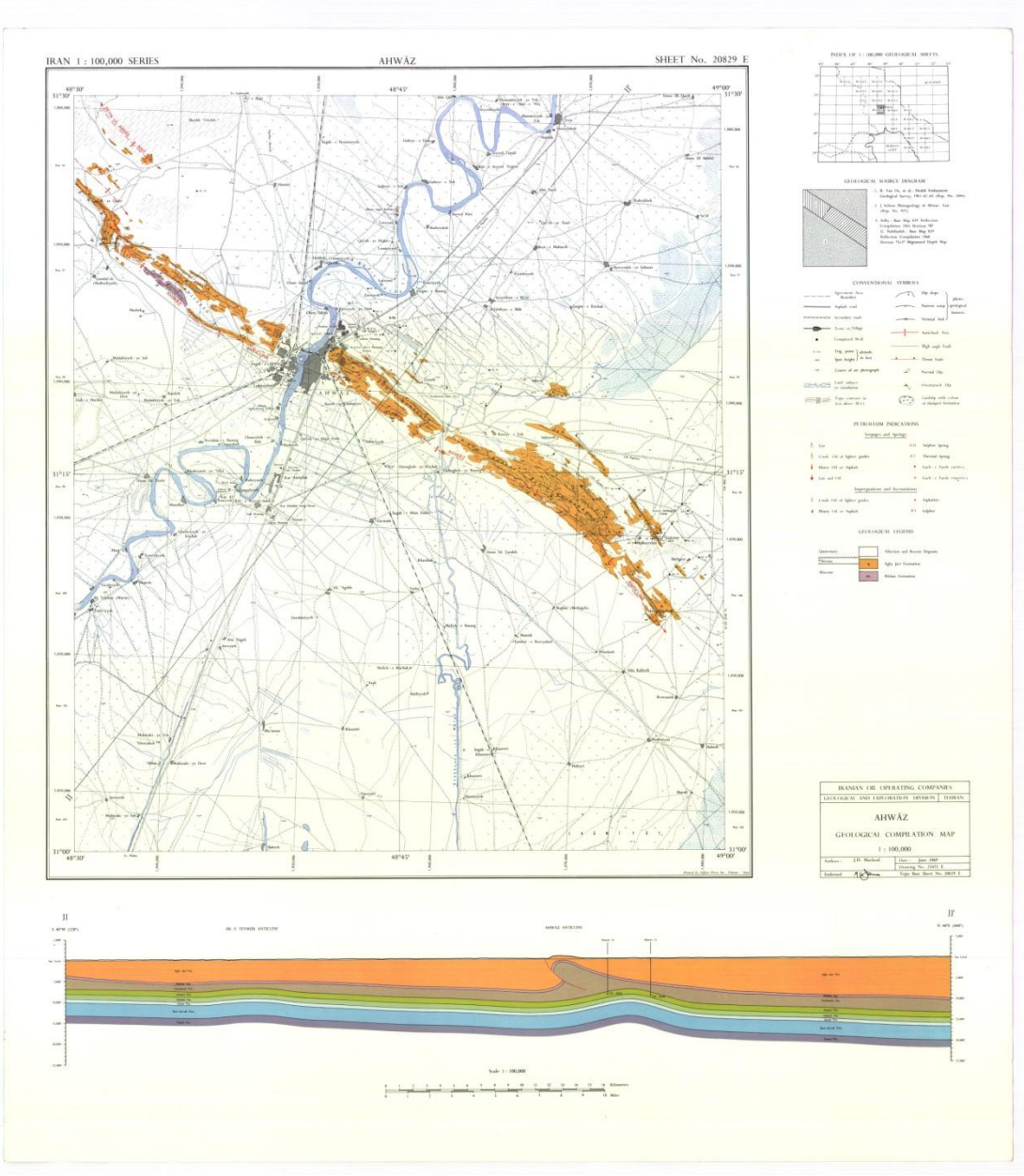


Figure 1. Geological map of Ahwaz City (1:100000, National Iranian Oil Company). Ahwaz Fault passes through the center of the city with northwest-southeast trend. The brown colour in the map shows Aghajari Formation which is located in hanging wall part of Ahwaz Fault.

RADON GAS MEASUREMENT TECHNIQUE

Radon (Rn) is a gasous element and could be released from interior layers to surface through the faults and joints. Alph**a** particles are emitted from Radon, so Radon gas can be measured by this property (Ghanadi Maraghe, 2003). The unit of measurement of Radon gas is Beqrel and it is shown by Bq/m^3. Radon measurement technique is proved to be a good tool for detection and mapping of active faults, and also in the case of continous monitoring of Radon anomalies related to earthquake events (Inceoz M. et al., 2006). In this study track detector RAD7 is used in order to determine the changes of Radon gas density in Ahwaz Fault district.

Measurement of Radon gas could show the different isotope in the air, soil, rock and water. Positive points of this method are as follow:

- Specify the ore minerals, reserves, and hiden structures.
- Measurement of alpha decay and specifiy the origin of Radon element (from Th or U).
- Measurement of Radon in lakes and springs to investigate the potentialities.
- Reliable method to investigate the radioactive elements.
- Reliable method to discover the hidden faults and fractures is radon measurement.

Inspide of mentioned positive points for Radon measurement techniques, this method has some limitations also, like:

- Detailed measurement of Rn^{222} needs special filtering.
- Leaving Radon gas could be change in moisty wheather condition, low permability of the soil, wind speed and thickness of the surface soil.
- Radon measurement needs joint and fractures to let the Radon gas reaches to ground surface.

FIELD STUDY OF RADON GAS MEASUREMENT FOR AHWAZ FAULT

In order to find the trend of Ahwaz Fault, Radon measurement was carried out in two section. The first section is located in south east of Ahwaz City in Bogaan 2 (Mosharahat Mountain) and the coordinations are:

0300458E _ 0300256 E
3453198N _ 3452891 N

The second section is located in north west of the Ahwaz City, near Hamidieh Road and the coordinations are:

0271070E_0270975 E
3471551N_3471377 N

The result of these measurements are presented in two graphs (Figure 3 and 4). The location of sections were chosen in dry, area with no plantation and also high possibility to cross the Ahwaz Fault. To perform the test, a special one meter suction pipe should be run in ground surface soil. The soil air is sucked by suction and is pumped inside the Radon measurement instrument in order to measure the density of Radon gas.

In Zagros Mountain chain area, most of the mineral springs show high radiation with regard to concentration of Ra^{+2}. Ra^{+2} has similar chemical characteristics with Sr and Ca which concentrates in the water of gas and pettrolume reserves. Radiom ^{226} is a radioactive element which is radiant an alpha particle and change to Radon ^{222}. Radiom is solved in the water and deposited in water of springs, but Radon gas is released into the atmosphere.

Despite of some restriction such as soil pernability, and passage limitation to sublimation the Radon gas, Ahwaz Fault Zone shows certain anomalies. It represents that Radon gas reaches to surface layer of the ground through Ahwaz Fault crash zone joints and accumulates in top soil layers. In addition to find the exact location of Ahwaz Fault during this study, clear indication of Ahwaz Fault activity are recorded.

Table1. Alpha Particle Decay in Radon Element.

NO.	Radioactive Element	Life Time	Maximum Energy (MEV)
1	222Rn	1600 Year	4.69
2	220Rn	3.825 Year	49.5
3	218Rn	0.035 Sec.	7.13
4	210Rn	138.38 Day	5.36

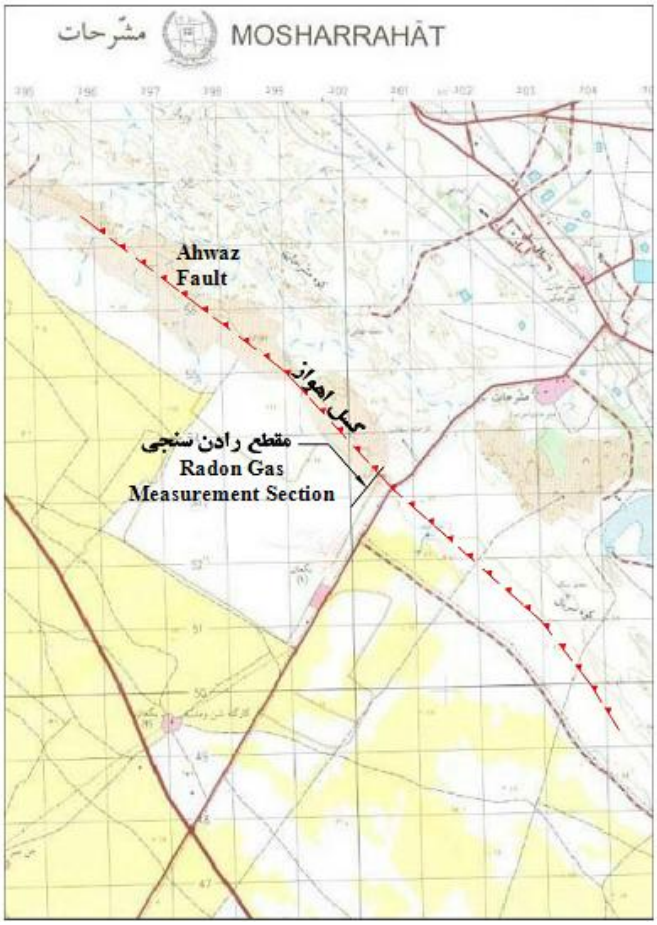
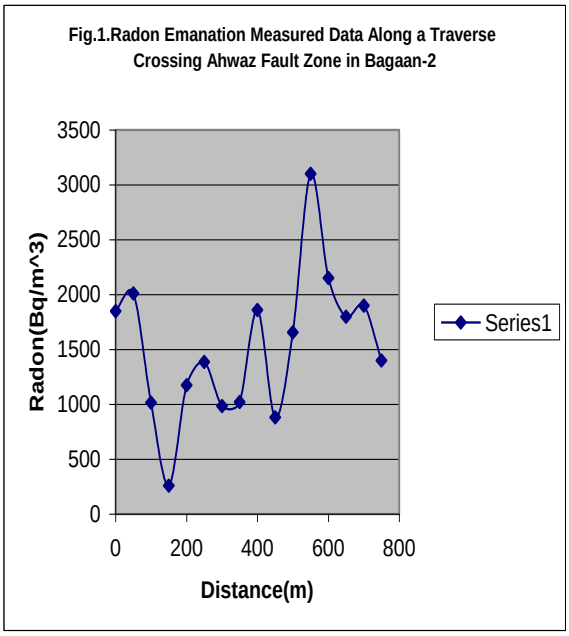


Figure 2. Radon gas measurement in Mosharahat Mountain, Bogan 2 area.



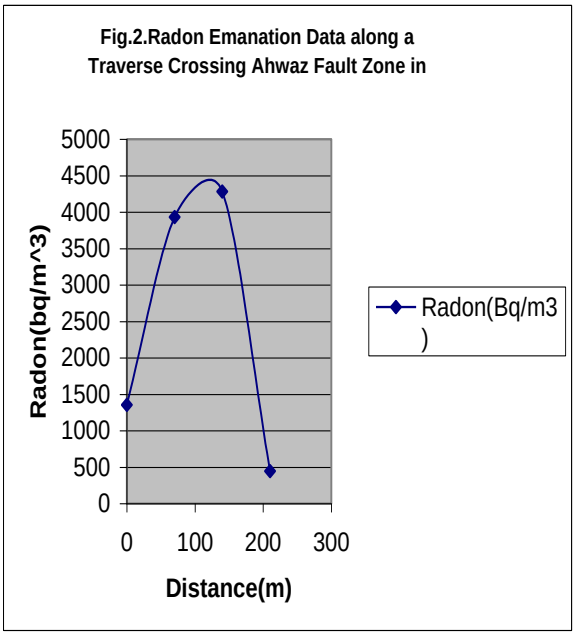


Figure 3 and 4. Measurements of soil Radon gas in, Mosharahat Mountain (left) and Hamidieh Road (Right).

Figure 5 and 6- Measurement of Gas Radon in the field.

CONCLUSIONS

As it is presented in Figures 3 and 4, the mesurement results of Radon gas, show clear increase or pick on Ahwaz Fault (Samani B. et al, 2007). These graphes indicate the exact loction of Ahwaz Fault in northwest and southeast of Ahwaz City. More over the results of measurements of soil Radon gas in Ahwaz Fault determine this structure as an active fault and continue to deep part of crust (Hesami Kh. et al, 2003). If such experiments are repeated, the rate of Ahwaz Fault activity could be measured clearly.

REFERENCES

Ghanadi Maraghe M (2003) Fundamentals and Applications of Nuclear Chemistry and Radio Chemistry, Organization of Atomic Energy of Iran, 705

Hesami Kh, Jamali F, and Tabasi H (2003) Major Active Fault of Iran, 1:2500000 scale map, Ministry of Science, Reaserch and Technology, International Institude of Earthquake Engineering and Seismology, Tehran, Iran

Inceoz M, Baykara O, Aksoy E and Dogru M (2006) Measurement of Soil Gas Radon in Active Fault System: A Case Study Along the North and East Anatolian System in Turky, ELSEVIER, Vol. 41, Page 349-353

Mac Leod JH (1969) Ahwaz Geological Map, 1:100000 scale map, IRANIAN OIL OPERATING COMPANIES

McQuarrie N (2004) Crustal Scale Geometry of Zagros Fold – Thrust Belt, Iran, Jurnal of Structural Geology, Vol. 26, P. 519 – 535

Samani B and Esmaeili B (2007) Assessment Report of Route One and Route Two in “Ahwaz Urban Railway Project”, Kayson Company, in Persian

Torabi and Ghasemi (2004) Kinematics Analysis of Reservoir Horizons in the oil fields of Dezful Embayment, Geosciences. Vol. 12, no. 51 - 52 (ISBN: 1023 - 7429) in Persian