International Journal of Advance Research in Science and Engineering
Vol. No.6, Issue No. 03 , March 2017
www.ijarse.com
IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

INDOOR RADON MEASUREMENT FROM SOME REGIONS OF TARN TARAN DISTRICT OF PUNJAB

Neerja[1], Sameer Kalia[2], Meetu Singh[3]

[1,2]PG Department of Physics, DAV College, Amritsar (Punjab) (India)

[3]Department of Applied Sciences, IK Gujral Punjab Technical University, Jalandhar, Punjab (India)

ABSTRACT

Radon has been given increasing attention due to its significant health hazards. In the present research, radon concentration was measured in 20 dwellings of 10 regions belonging to Tarn Taran district of Punjab. The measurements were done by using LR-115 SSNTD (solid-state nuclear track detector). The concentration of radon was found to vary from 18. 61 to 98.54 Bqm^{-3} which is less than the lower limit of the action level (200-300 Bq m^{-3}) recommended by International Commission on Radiological Protection.

Keywords: Lower limit, LR 115, Radon Concentration, SSNTD.

I. INTRODUCTION

Considerable interest has been expressed worldwide for the study of naturally occurring radiation and environmental radioactivity. This interest has led to the performance of extensive surveys in many countries [1]. The primary reason for these studies is the simple fact that natural radiation background is the primary source of human radiological exposure. Radioactivity present in human environment is the major source of radiation dose being received by population. Naturally occurring radionuclides like Uranium have existed in the Earth's crust since its formation. Radon (Rn-222) is a radioactive gas derived from the Uranium decay series and it is the main source of internal radiation exposure to human life [2]. As radon undergoes radioactive decay, it gives off radiation and becomes another radioactive element. Radon is a noble gas, and is chemically inert in nature. Its most common isotope, Radon 222 has a half-life of 3.8 days and comes from the alpha decay of Radium-226 (half-life 1600 years). Epidemiological studies have shown that exposure to indoor radon and it progeny does increase the risk of lung cancer [3, 4]. It is an established fact that the enhanced levels of indoor radon in dwellings can cause health hazards and may cause serious diseases like lung cancer in human being. According to the US Environmental Protection Agency (EPA) and the World Health Organization (WHO) Handbook on Indoor Radon (WHO, 2009) radon is the second leading cause of lung cancer after smoking [5, 6]. Radon gas escapes easily from rocks and soils into the air and tends to concentrate in enclosed spaces, such as underground mines, houses, and other buildings. Soil gas infiltration is recognized as the most important source of residential radon. The radiation dose from inhaled decay products of radon (222Rn) is the dominant component of radiation exposure to the general population and causes an increased risk of lung cancer [7]. Residential radon is regulated by a reference level of radon concentration between 200 and 300 Bqm^{-3} based on International Commission on Radiological Protection recommendations [8]. Radon has no commercial uses other than as a

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

radiation standard for calibrating radon monitoring equipment in support of environmental surveys of homes and other buildings. Radon in soils and rocks mixes with air and rises to the surface where it quickly dilutes in the atmosphere. Many extensive studies have been performed on radioactivity worldwide and on measurement of indoor radon in various regions in recent years. The present work tries to explore the radon concentration dwellings of regions belonging to Tarn Taran district of Punjab.

II. GEOGRAPHY OF THE STUDIED AREA

The study area covers some regions of Tarn Taran district which is one of the districts in the state of Punjab in North-West Republic of India near the India-Pakistan border as shown in the map in Fig.2.

Figure 2: Map of Tarn Taran District

III. EXPERIMENTAL TECHNIQUE

In the present work, LR-115 type II plastic track detector films in the bare mode technique were used to measure the concentration of radon in the indoor environment [10] . The detectors of size 1.5 cm X 1.5 cm were suspended in the rooms of the dwellings at a height >2 m above the ground level (so that the detectors were not disturbed by the movement of the residents) and about 1 m below the ceiling of the room so that direct alpha particles from the building material of the ceiling did not reach the detectors. After exposure of 90 days the detectors were removed and etched using 2.5 N NaOH solutions at (60$\pm$1) ºC for 90 min in a constant temperature bath. Chemical etching is essential for enlargement of the tracks, so that they become visible under the optical microscope [11]. The etching of samples was carried out in a constant temperature bath manufactured by Narang Scientific Works Pvt. Ltd. New Delhi as shown in fig.2. It provides an accurate and precise temperature control of the etchant solution with an accuracy of $\pm$1˚C. After thorough washing, the detectors were scanned for track density measurements using an optical microscope at a magnification of 400X. The track density so obtained was converted into the units of Bqm^{-3} of the radon concentration using the calibration factor of 0.020 - 0.002 tracks cm^{-2} d^{-1} (Bq m^{-3}) determined experimentally by Eappenet.al [12], which satisfies the conditions prevailing in the Indian dwellings. In the bare mode technique there can be some

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

contribution from thoron (220Rn) also. However, the report by UNSCEAR (2000) reveals that the contribution from 220Rn and its progeny in dwellings is in general about 10% of that of 222Rn and its progeny. So this component can be neglected from the point of view of inhalation dose [13].

Figure 2: Etching Bath

IV. RESULTS AND DISCUSSIONS

The results of measurements are summarized in tables 1. A total of 20 samples were employed at 10 different locations of studied region. The estimated average indoor radon concentration values varied from 18. 61 to 98.54 Bqm^{-3}. ICRP recommended the lower limit of the radon concentration action level in the range of 200-300 $Bq\ m^{-3}$.

Table 1: Results of measurements of average radon concentration.

Sample no.	Location	Number of Samples	Average Radon conc. in Bqm^{-3}
1.	Daburji	2	32.69
2.	Jamarai	2	19.65
3.	Rasulpur	2	21.73
4.	Palasaur	2	65.38
5.	Aladinpur	2	18.61
6.	Dhotian	2	45.98
7.	Baath	2	78.69
8.	Nusshehra pannua	2	56.29
9.	Fatehabad	2	98.54
10.	Gohalwar	2	27.60

IJARSE
ISSN (O) 2319 - 8354
ISSN (P) 2319 - 8346

V. CONCLUSIONS

As mentioned above, indoor radon levels have been measured for 20 samples employed at 10 locations of Tarn Taran district of Punjab, India. The average radon concentration varied from 18.61 to 98.54 Bqm^{-3}. The values obtained for radon concentration lie well below the lower limit of 200-300 Bq m^{-3} as recommended by ICRP.

REFERENCES

[1] UNSCEAR (United Nations Scientific Committee on the Effects of Atomic Radiation), Ionizing Radiation: Sources and Biological Effects, New York: United Nations, 1994.

[2] Liendo, J., Sajo-Bohus, L., Palfalvi, J., Greaves, E.D., and Gomez, N.Radon monitoring for health studies in the Caracas subway using SSNTDs. Radiat. Measur. , 28 (1-6), 729 –732 (1997).

[3] Lubin, J.H. and Boice, J.D. Lung cancer risk from residential radon meta-analysis of eight epidemiology studies. J. Nat. Cancer Institute, 89 (1) ,49 -57,1997.

[4] Field, R.W., Steck, D.J., Smith, B.J., Brus, C.P., Neuberger, J.S., Fisher, E.F., Platz, C.E., Robinson, R.A.,Woolson, R. F. and C.F. Lynch. Residential Radon gas Exposure and Lung Cancer: The Iowa Radon lung Cancer Study. Am J. Epidemiol, 151 (11), 1091-1102, 2000.

[5] WHO handbook on indoor radon - a public health perspective, Geneva, World Health Organization, 2009.

[6] EPA (Environmental Protection Agency)"Radon Reference Manual", Office of Radiation Programs Washington DC 20460, EPA 520/1-87-20, September 1987.

[7] Tokonami, S. Why is 220Rn (thoron) measurement important?Radiat. Prot. Dosim. 141(4), 335–339, 2010.

[8] International Commission on Radiological Protection. Lung Cancer risk from radon and progeny and statement on radon. ICRP Publication 115 Annals of the ICRP, 40(1), 2010.

[9] Mudd, G. Radon sources and impacts: a review of mining and non-mining issues. Reviews in Environmental Science and Biotechnology, 7 (4): 325-353, 2008.

[10] Mishra,U.C. and Ramachandran, T.V. Indoor radon levels in India: a review. Proceeding of Third International Conference on Rare Gas Geo-Chemistry Applications in Earth and Environmental Sciences held at GND University, Amritsar during 10-14 December, 310-319, 1995.

[11] Ramola, R.C., Kandari, M.S.,Rawat, R.B.S., Ramachandranand,T.V., Choubey, V.M. A study of seasonal variation of radon levels in different types of houses. Journal of Environmental Radioactivity, 39(1), 1-7, 1998.

[12] Eappen, K.P., Ramachandran, T.V., Shaikh,A.N. and Mayya, Y.S. Calibration factor for SSNTD-based radon/thoron dosimeters. Radiation Protectionand Environment, 24(1&2), 410-414, 2001.

[13] UNSCEAR,Sources and effects of ionizing radiation. Exposure due to Natural Radiation Sources (Vol. 1). New York: United Nation, 2000.