ESTIMATION OF INDOOR RADON LEVELS IN SOME DWELLINGS OF MISURATA REGION – LIBYA

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ABSTRACT

Inhalation of indoor radon has been recognized as one of the health hazards. In the present work a set of indoor radon measurements were carried out, in a random sample of housing seven villages from the city of Misurata located in north-central Libya which was built of the same type of materials, Radon concentration determined by Safety Siren, Pro3, Radon Gas Detector. Measurements were carried out on August 2015.

The results show that, the radon concentrations varied from (4 to 355) Bq/ m³. The mean concentrations values of radon was 74 Bq/ m³. This data shows that, the mean of radon concentrations in study's dwellings falls within the safe limits. Despite recording a high concentration of this gas in the areas of: Dafniya, Abo Rwia, Zawet-Mahjoub and Kerzaz. A matter of concern and urges more measurements and investigation.

Keywords-Radon pollution, Indoor radon, Radon health risks, domestic pollution, radiations, domestic pollutants, Indoor air pollution impact and Libyan dwellings pollution.

1.INTRODUCTION

In recent years, substantial attention has been paid to radon, particularly to the problems of exposure to radon and its progeny in building and dwellings. Nationwide measurements of radon activities in the indoor air of dwellings are continuously presented all over the world [10,15,18]. Radon is a radioactive noble gas that is founed as natural deposits of uranium throughout the earth's crust decay. It's a colorless, odorless, tasteless, chemically inert gas; and has a suitable hafe-life of 3.82 days [4]. It

contributes one half of the total annual dose from radiations of all kinds [5,22].

The inhalation of radon and its radioactive daughters, even for people exposed to low radon levels that may be found in residential buildings [16], increase the chance of developing lung cancer [19]. When inhaled, radon particles carrying daughter form enter and stick onto the bronchial air passages, irradiating and damaging the surrounding cells. Based on national and worldwide investigations, several agencies have concluded that radon is considered as a known cancer causing agent in humans and regard as the second most common cause of lung, skin, and leukemia cancers after smoking [1]. Radon enter the body systems during inhalation, which results in an increase in the exposure dose that can result in the development of lung cancer. Radon and its progeny in air are the most important contributors to human exposure from all natural radiation sources [21]. Radon is regarded as a risk factor that contributes to the global burden of diseases. In general, residential radon regulated by a radon concentration action level between 200 and 600 Bq/ m^3 based on International Commission on Radiological Protection "ICRP" recommendations [8]. Recently, however, an increase in lung cancer risk has been observed even with exposure levels 200 Bq/ m^3. In view of such scientific data, [23] proposed a reference level of 100 Bq/ m^3 to minimize health hazards due to indoor radon exposure. Researches carried out in recent decade's show, under normal conditions, ingestion of natural radioactive gas radon and its decay products. Long term exposures to radon via inhalation in closed rooms or caves or open air saturated with radon gas are the cause of about

10% of all deaths from lung cancer [20]. Also, studies related to radon on kidney and malignant melanoma cancer have been reported [7].

Despite the global and regional interest of assessment studies of radon concentrations in the indoor air, this danger gas did not have the appropriate care in Libya. The current study investigates the distribution of indoor radon concentrations in some dwellings of Misurata region in Libya.

2.MATERIALS AND METHODS

The Study Location and Measurement Sites

30 random sample homes are included in the study. Selected from the following areas: Dafniya (DA), Abu Rwia (AB), Zawet-Mahjoub (ZA), Ghiran (GH), Kerzaz (KE), village of Sekerat (SE) and Al Zarog (ZR).

These areas are a population centers surrounding Misurata's down town from the western, southern and eastern sides. The study areas are the homes as floor houses composed of one floor. This study was conducted during the month of August 2015, where measurements were conducted in the middle of almost every home, for 24 hours.

Radon Measurement Instrument

The measurement of indoor radon concentration was carried out using Safety Siren, Pro series 3, Radon gas detectors, model; HS71512.

The detector is manufactured to read radon concentration. It is characterized by its ability to record concentration of long-term average and short-term average. It has been compiled results of measurements of long-term and short-term for each area separately in tables prepared for it in advance.

Where the arithmetic mean calculation, and showed the maximum and minimum values. Statistical analysis of data was performed using SPSS software to analyze the results using one way ANOVA test.

3.RESULTS AND DISCUSSION

Table 1 summarizes the radon concentration levels in the study areas during short-term ranged from 4 Bq/ m^3 to 355 Bq/ m^3. The average concentration was between 18-131 Bq/ m^3. p-value were greater than 0.05 which refer to a non – significant differences between the obtained results.

TABLE 1. SHORT TERM RANGE AND MEAN OF INDOOR RADON CONCENTRATION, IN THE HOUSES OF THE STUDY AREAS IN MISURATA REGION, (B Q/ M^3), AT AUGUST 2015.

Measurement Sites	MaX.	MIN.	MeaN
AD	107	57	86
AB	352	37	175
ZA	355	18	131
GH	44	4	25
KE	94	38	53
SE	35	29	31
ZR	24	13	18

Table 2 shows that the radon concentration levels in the study areas during the long-term (7 days) ranged between 11-233 Bq/ m^3 concentration. The average concentrations were between 16-98 Bq/ m^3. Also it is found that p-

value = 0.005 <0.05. Which shows that the results of the study areas were significant differences.

TABLE 2. LONG TERM RANGE AND MEAN OF INDOOR RADON CONCENTRATION, IN THE HOUSES OF THE STUDY AREAS IN MISURATA REGION, (B Q/ M³), AT AUGUST 2015.

Measurement Sites	MaX.	MIN.	MeaN
AD	180	43	89
AB	233	14	96
ZA	124	11	76
GH	42	33	39
KE	109	89	98
SE	30	18	22
ZR	19	14	16

From the above results, it is clear that the average concentration of radon gas in some dwellings of Misurata, region in Libya for the short term was 47 Bq/ m³ and that for long term is 62 Bq/ m³.

The value of radon concentrations obtained in this survey were higher when compared with those reported in Saudi Arabia [12.17], Syria [14], Kuwait [2], Algeria [3] and Egypt [9]. The results of this study coincided with the results of similar studies in the United States [11], and Australia [17]. On

the other hand, the results of the present study was low compared to log in Iran [16], Italy [6] and Hungary [13].

No level of radon is considered safe. In fact, many countries set their national exposure levels based on their own studies. The American Environmental Protection Agency [17] limits radon action level of 148 Bq/ m^3. This reference represents the acceptable indoor radon level in order to limit the risk to individuals and alter them when action should be taken. In Europe, the reference level varies depending on the age of the building. Some European countries have more than one reference level, but in general it does not exceed 400 Bq/m-3. The Commission of the European Communities [23] has recommended two Action levels, 200 Bq/ m^3 for new homes and 400 Bq/ m^3 for old and existing homes. Meanwhile, some countries that have not determined a national reference level, such as Saudi Arabia, have adopted WHO action reference levels of 100 Bq/ m^3 to minimize health hazards due to indoor radon exposure [1]. Where the results of this study are located in the lower levels of those limits.

4. CONCLUSION

The most important forms of radon from a health viewpoint is radon 222. Its decay products, especially Po218 and Po214, can have a pronounced adverse effect on lung tissues, leading to lung cancer in many cases.Radon entry into dwellings usually occurs through cracks, joints, pipes, fittings in wall, loose sealants or caulking around windows, and so on. Based on the portable device Pro series3, radon gas detector, radon was measured in air inside of 30 sample of Misurata region dwellings in Libya. Radon levels

ranged from 4 to 355 Bq/ m^3, with a mean value of 74 Bq/ m^3, the mean results were below the action level recommended by WHO of 100 Bq/ m^3.

On the basis of the current results, it could be concluded that in some Misurata' dwellings in Libya, the levels of indoor radon are well within acceptable limits.

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