

A Survey of Radon level in Surface Water at Amphoe Muang Maha Sarakham with Ionization Chamber

Vitsanusat Atyotha¹, and Patapong Panpiboon²

1. Department of Applied Physics, Faculty of Engineering, Rajamangala University of Technology Isan, KhonKaen Campus, Thailand

2. Department of Physics, Faculty of Science and Technology, Rajabhat Mahasarakham University, Thailand

Abstract: The Radon level in 69 Surface water samples of Amphoe Muang Maha Sarakham were determined by using Ionization chamber. The Radon concentrations of all samples were in the range of 0.027-0.203 Bq/l with the average of 0.082 Bq/l. The risks of Annual Equivalent Dose were found to be in the range of 0.19-1.48 μ Sv/y with the average of 0.60 μ Sv/y. The results were then compared to the standard value of the US Environmental Protection Agency (Radon concentration should be less than 11 Bq/l for drinking water and less than 150 Bq/l for using water and Annual Equivalent Dose should be less than 0.1 mSv/y). It was found that both radon concentrations and annual equivalent doses of all surface water samples were lower than the standard values. Therefore, surface water at Amphoe Muang Maha Sarakham is safe for consuming without carcinogens (Radon).

Key words: Radon, ATMOS 12 dpx, surface water, Maha Sarakham

1. Introduction

Radon is a radioactive that can accumulate in the environment, such as rocks, soil, water, plants and food [1]. However, if radioactive is accumulated in the human body in high level, it will affect human health. When people drink water containing high concentration of radon, this radon can be a cause of cancer in various organs such as the lungs, liver, kidneys and endocrine organs [2, 3]. When ground water evaporate, Radon can release Alpha decay into the air. When the air is breathed, the alpha radiation can damage lung tissue and cause a lung cancer. Radon is found to be the second leading cause of lung cancer, where the first one is cigarette. The study reported that each increase of 1 Bq/m³ (Radon in water every 0.001 Bq/l) in radon concentration in the air will increase the chance of lung cancer more than 1.6×10^{-4} times [4]. Moreover, Radon can accumulate

in the body by breathing and consumption of water and food. This will finally affect human health in future.

The researchers are aware of the problems in this regard, so we have measured the amount of Radon in surface water that people use on a regular basis. We choose to study water samples from villages in research areas in order to evaluate the safety level and the risks that affect the health of people in the study area.

2. Materials and Methods

2.1 Surface Water Sampling

The 69 sampling of surface waters in the village at Amphoe Muang Maha Sarakham were packaged in 500-milliliter bottles. In order to prevent radon in the water to leak out a lot, Radon concentration in water samples were measured as soon as possible (less than 1 week) by Ionization chamber at Radon laboratory of Thailand Institute of Nuclear Technology (Public Organization).

Corresponding author: Vitsanusat Atyotha, research areas/interests: nuclear technology and radiation protection. E-mail: v_atyotha@hotmail.com.



Fig. 1 Surface water sampling.

2.2 Ionization Chamber)Radon Gas Monitor ATMOS 12 DPX(

A 300 mL of Surface water sample was pumped into the sampling device connected to the ATMOS 12 DPX (shown in Fig. 2). ATMOS 12 DPX will measure the average Radon concentration in a unit of Bq/m^3 .

2.3 Annual Equivalent Dose Analysis (AED)

The amount of Radon concentration received per year from drinking contaminated water supply caused by the Radon (Annual Equivalent Dose, AED) was calculated from equation [4]:

$$\text{AED} = A \times W \times \text{Dose factor}$$

AED = Radiation received per year (mSv/y)

A = activity of ^{226}Ra in water (Bq/l)

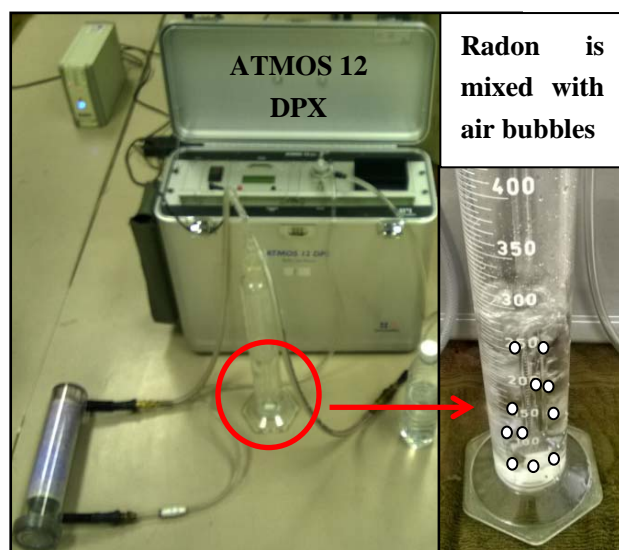


Fig. 2 Set-up for radon concentration measurement by Ionization chamber.

W = Water consumption per year in men to drink at least two liters a year, so one would have to drink at least 730 liters

3. Results and Discussion

From 69 water samples, the Variance Value (S²) and the Standard Deviation (S) of Radon were found to be 0.001 and 0.034, respectively. Since there are many sampling areas, 13 interesting regions with high average of Radon have presented in the Table 1. It can be seen that both Radon concentration and Annual Equivalent Dose) are lower than the standard values of US Environmental Protection Agency [5, 6].

4. Conclusions

The radon concentration, which can be a risk factor for cancer in people, in 69 Surface water samples at Amphoe Maha Sarakham was studied by using Ionization chamber. The Radon concentration of all sampling water was found to be in the range 0.027-0.203 Bq/l with the average value of 0.082 Bq/l . The Annual Equivalent Dose of all sampling water was found to be in the range of 0.19-1.48 $\mu\text{Sv/y}$ with the average value of 0.60 $\mu\text{Sv/y}$. These results are lower than the standards value of US Environmental

Table 1 Radon and AED in water supply

Research areas	Radon (Bq/L)	AED ($\mu\text{Sv/y}$)
1. Three separate Road of Kalasin	0.203	1.48
2. Klong Somthavil	0.147	1.07
3. Serm Thai khao	0.143	1.05
4. Moo 12 Ban Tio	0.137	0.99
5. Rajabhat Mahasarakham University	0.130	0.95
6. Moo 4 Ban Man Yai	0.130	0.95
7. Khog Ghou Reservoir	0.130	0.95
8. Ban Nong Don	0.127	0.93
9. Moo 5 Ban Khog Sri	0.127	0.93
10. Moo 10 Ban Non Dou	0.120	0.88
11. Moo 6 Ban Don Rou	0.113	0.83
12. Moo 9 Ban Nong Wai	0.113	0.83
13. Moo 3 Ban Tha Pha Tai	0.110	0.80

Protection Agency. However, People are unsure whether water is safe or not therefore a way to prevent the risk of radon-contaminated Surface water affecting public health should be discussed. Using a water filter with aeration (Aeration System) or a filter with the filter scale carbon (Granular activated carbon) is a promising way to protect the surface water from radon contamination. Carbon filters tend to cost less than Aeration System, but radioactivity collected on the filter may require special disposal methods for platelet carbon filter [7, 8]. Moreover, the condition and lifespan of this filter should be regularly checked. This filter should be replaced immediately if it expires.

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