The Comparative Analysis of Rn-222 in Water for Public Supply Pump Houses of Ulaanbaatar City

Ts.Oyunchimeg* · G.Khuukhenkhuu† · N.Norov†

*Medical University of Mongolia, Ulaanbaatar City
†Nuclear Research Centre, National University of Mongolia, Ulaanbaatar City

The results of the measured specific activities of Rn-222 in water for public water supply pump houses (wells) of Ulaanbaatar City, Mongolia using the HP-Ge gamma-spectrometer, are described. The average of the specific radioactivies for the Rn-222 were for the station "Centre" 82.59 Bq/l, station "Combinat" 91.35 Bq/l and station "Makh" 158.25 Bq/l, respectively .

Key words : Water, Radon, HP-Ge gamma-spectrometer

INTRODUCTION

The need to define the quality of the water is increased with the rising demand for the water which is suitable for drink.[1)]

Accurate determination of radon (Rn-222, half-life $T_{1/2}$=3.8 d) concentration in water is necessary in the fields of geochemistry and health physics. Radon and its short-lived daughter nuclide products are deposited in the lung which receives a dose from alpha radiation emitted during subsequent decays. As a result of such irradiation the lung cancer is perhaps provoked. Lung and stomach cancer can be resulted by exposure of 222Rn in drinking water.[2)]

We have developed the method to determine the specific radioactivity of Rn-222 in water using the HP-Ge gamma-spectrometer, solid state nuclear track detector and liquid scintillator.[3, 4)]

In this paper the results of the measured specific activities of Rn-222 in water for public water supply pump houses (wells) of Ulaanbaatar City, Mongolia using the HP-Ge gamma-spectrometer, are described.

METHODS AND MATERIALS

Using the HP-Ge gamma-spectrometer the specific radioactivity of Rn-222 in water was determined by 295.21 keV and 351.92 keV gamma-rays from ^{214}Pb and 609.31 keV gamma-ray from ^{214}Bi [3]. Both of ^{214}Pb and ^{214}Bi are the radon's short -lived daughter nuclides.

As a sample, 1,000 ml water was directly poured in Marinel vial and a screw cap was tightly closed. The gamma-ray measurement of the water sample started about 4 h later for establishment of radioactive equilibrium between the radon and the short - lived daughter nuclides.Measurement time was about 1 h .

Detecting measurements of the short lived radionucleds (^{214}Pb, ^{214}Bi) of Radon in the water were done by the gamma spectrometer of Nuclear Research Centre at the Mongolian National University. The energy resolution limit of the spectrometer was 2 keV at the 1332,5 keV energy line of ^{60}Co-source.

The detection efficiency was determined using the 2 different standard solutions made in the Amersham Co. (1996) and in the California (1994).

The system of public water supply of Ulaanbaatar city is divided into 3 stations, which named the "Central", "Combinat" and the "Makh". The stations are further into pump houses (wells).

In order to compare of the measurement results of the Rn-222 specific activities in water we have took water samples in one day from 27 different pump houses (wells) of public water supplies in Ulaanbaatar city. The measurements were not done with the water samples before or after purification.

Submitted November 16, 2002 accepted December 30, 2002

Table 1. Measurement results of Rn-222 specific activities in water of pump houses for the 3 stations

The number of pump houses (wells)	Rn^{222}, Bq/l	The station
1	96.4±4.7	Central
N-4	92.2±6.9	
8	85.8±5.6	
12	93.5±7.8	
14	87.0±6.5	
15	95.0±4.7	
16	63.2±5.3	
24	33.4±6.7	
25	29.1±8.6	
26	34.9±6.5	
31	96.2±7.6	
32	104.5±4.2	
34	104.9±4.3	
37	74.7±7.5	
38	98.9±5.6	
45	91.0±5.4	
47	90.6±6.5	
48	79.6±8.5	
49	118.2±2.1	
Average	82.6±6.0	
3	73.4±6.4	Combinat
4	82.7±9.1	
5	143.4±5.2	
6	65.9±6.3	
Average	91.3±6.7	
3	197.4±5.3	Makh
4	139.7±4.3	
5	153.1±6.2	
10	142.7±5.4	
Average	158.2±5.3	

RESULTS AND DISCUSSION

The measurement rCombinatesults of the Rn-222 specific activities in water samples taken at different pump houses (wells) of Combinat public water supply for the 3 stations in Ulaanbaatar city, in October, 2002 (measured by HP-Ge gamma-spectrometer), are presented in Table 1.

It has been seen that the measurement results of the Rn-222 specific activities in three different stations of the public water supplies of Ulaanbaatar city are different from each other.

The average of the specific radioactivies for the Rn-222 were for the station "Centre" 82.59 Bq/l, station "Combinat" 91.35 Bq/l and station "Makh" 158.25 Bq/l, respectively .

Thus, the average of the specific radioactivity for the Rn-222 in station "makh" was the highest from other station's average value.

It should be noted that standard level of the specific radioactivity for the Rn-222 in drinking water is less than 60 Bk/l and 100 Bk/l in Russia[5] and Australia, respectively. Therefore, we are planning to continue the study of the specific radioactivity for the Rn-222 in water of station "makh".

Radon is a radioactive gas that comes from the decay of radium in the soil. Radium is a decay product of uranium. Uranium is present in almost all rocks and soil and material derived from rocks. Mongolia has a

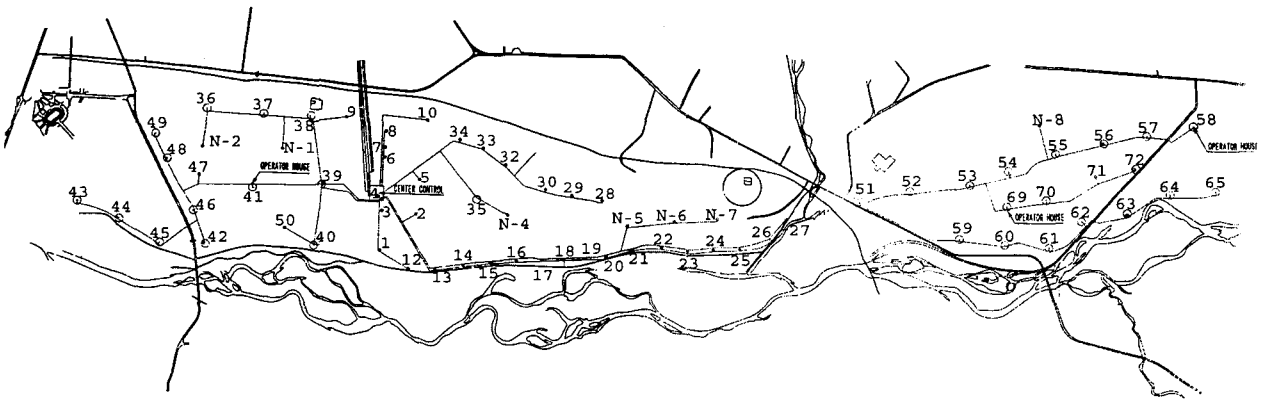

Fig. 1. Illustrative locations of the pump houses (wells) for the station "Centre" of the public water supplies of Ulaanbaatar city.

wide variety of uranium resources.

CONCLUSION

The average of the specific radioactivies for the Rn-222 in station "Centre" 82.59 Bq/l, station "Combinat" 91.35 Bq/l and station "Makh" 158.25 Bq/l were, respectively .

The average of the specific radioactivity for the Rn-222 in water of station "makh" is higher than standards of other countries like Russia and Australia.

Therefore, we have to continue the study of the specific radioactivity for the Rn-222 in water of station "makh".

REFERENCES

1. Biswas L, Asit K: Water Resources: environmental planning, management, and development. 1996, USA.
2. Newton BM, Watson JE, Cote RA: Quantitative Goals for a 222Rn Multimedia Mitigation Plan. Health Physics 81(5):575-579 (2001)
3. Norov N, Oyunchimeg Ts, Khuukhenkhuu G: Relative Analysis of the Nuclear Physics Methods for Determination of the Radon in Water. Scientific Transactions of the National University of Mongolia 159(7):131-137 (2000)
4. Oyunchimeg Ts, Norov N, Khuukhenkhuu G: Nuclear Physics Methods for Determination of Radon in Water. Korean Journal of Medical Physics, 13(1): 51-53 (2002)
5. Radiation Safety Standard (RSN-99) : SP 2.6.1.759-99. SPb-1999, Moscow