Monitoring of Environmental Gamma Dose Rate in Mongolia

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1. Introduction

The use of nuclear energy requires an environmental radiation monitoring system to ensure the safety of the environment and to protect people from the harmful effects of radioactive materials and nuclear accidents [1]. First nationwide environmental gamma dose rate monitoring system (EGDRMS) in Mongolia has started in 2003 to measure the ambient gamma dose rate and fallouts originated from the open-air nuclear accident happened in other countries such as Chernobyl accident. Radiation monitoring system in Mongolia are continuously monitored in a number of locations, and a large number stream of their data in the specific website. The monitoring work was carried out by Executive Office of the Nuclear Energy Commission. The results of environmental radiation monitoring are open to the public through the web site, http://nea.gov.mn and http://www.eic.mn/radiation/gis.php. Moreover, in recent years, in order to provide information to general public about the nuclear energy, measurement data is being reported publicly on government organization webpage [2, 3]. In this study, we analyzed environmental gamma radiation data that were measured throughout Mongolia since 2015. The objectives are to find out the nationwide environmental gamma dose rate to present the results to the interested public, and investigate the effectiveness of the system [4].

2. Methods and Results

The purpose of EGDRMS is to establish a national network of monitoring in different locations that will collect environmental radiation levels regularly. Early detection of radionuclide releases can minimize the consequences and assesses the impact on the environment. Since the monitoring system continuously monitors environmental gamma dose rate, it provides a large amount of time series data. The time series data gives the time stamp and length of its period in which the dose rate level has changed. The instrument also an alert if the measured dose rate level is greater than the predetermined threshold value which is 0.20 µSv/h [4].

At present, In Mongolia environmental gamma dose rate is continuously measuring at the 35 monitoring station. These monitoring stations are based on branch weather stations of the National Agency Meteorology and the Environmental Monitoring (NAMEM). Fig 1. Shows the environmental gamma dose rate monitoring posts in Mongolia.

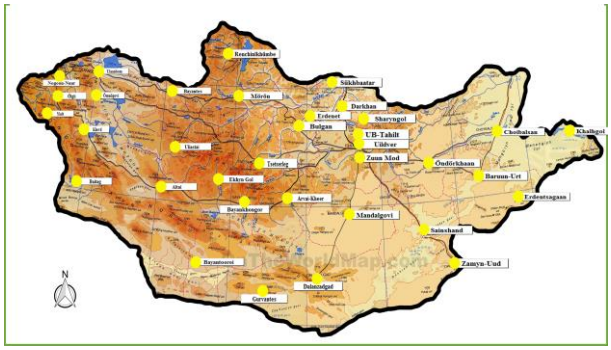

Fig. 1. Locations of monitoring stations

The structure of the EGDRMS is shown in Fig. 2. Each data was collected from all branch weather stations to NAMEM. The data analyzed by Executive Office of the Nuclear Energy Commission (NEC) after received from NAMEM. The data were collected, processed statistically and stored in a system. After these processing, calculations were done to get average dose rate for each station. An average dose rate calculated over the period of monitoring was also calculated and compared to environmental gamma dose rates around Mongolia.

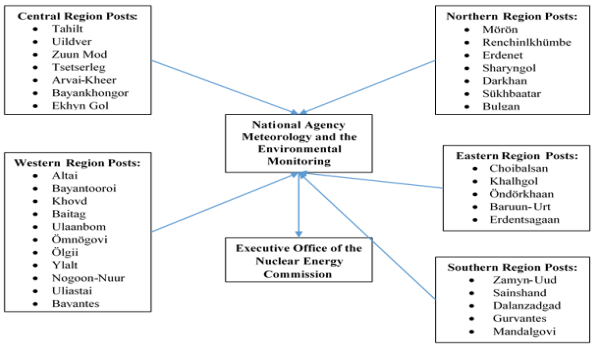

Fig. 2. Structure of EGDRMS in Mongolia

Environmental gamma dose rates are measured three times in a day above 1~1.2 meter from the ground by Geiger–Müller tube with the Rados-110 which has the dose rate range of 0.05 µSv/h to 99.99 mSv/h.

Table I: Specification of Rados-110 instrument

Item	characteristics
Detector	Geiger–Müller detector
Detector size	L 38 mm x 14 mm
Measurement range	0.05 µSv/h ~ 99.99 mSv/h
Energy response	50 keV ~ 1.3 MeV
Reading error	± 15 %
Operational temperature range	-25 ° C ~ 55 ° C

In this study, Mongolian environmental gamma-ray dose monitoring system was analyzed. The results of environmental gamma dose rate monitoring nationwide for past 4 years are summarized in Fig. 3 [2, 3].

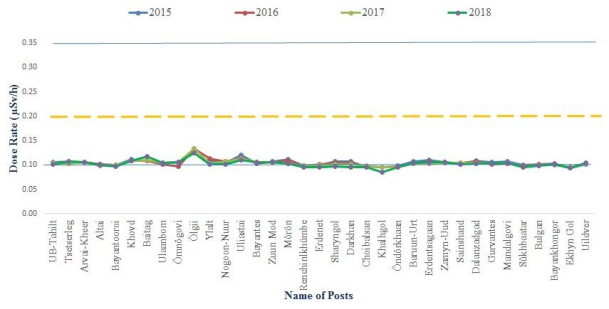

Fig. 3. Measurement results by year

The annual average of gamma dose rates obtained at 35 stations. For the year 2017, the highest value is 0.134 µSv/h at Ölgii station and the lowest value is 0.085 µSv/h at Khalhgol station. The two values are almost within the range of 0.085~0.134 µSv/h of recent 4 years. And, Uildver and Takhilt station of the Ulaanbaatar city were selected because of the most populated and administrative area in Mongolia. Its population was estimated 1.31 million in 2013, representing approximately 46 percent of Mongolia's total population. It was also selected on November because at that season there has been too much air pollution in Mongolia. After comparing these two station, it is found that there is difference on 8th November, but the value is below the threshold values which is shown in Fig. 4. These results indicate that there has been no sign of abnormal situation in Mongolia [5].

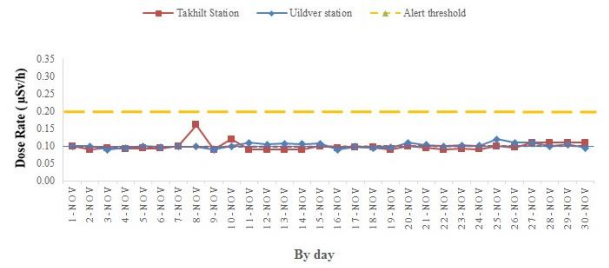

Fig. 4. Dose rate of Uilver and Takhilt stations

3. Conclusions

The environmental radiation monitoring system in Mongolia has been described in this study. We have found that all collected gamma-ray dose rate indicates normal environmental situations in Mongolia. Although no nuclear facility is currently operating in the Mongolia, it is located in a region surrounded by neighboring countries with several existing or planned nuclear power plants. Mongolia is trying to develop an on-line environmental radiation monitoring system that can provide real-time environmental during emergencies that lead to extensive spread of radioactive materials, such as nuclear power plant accidents. On-line radiation monitoring system will enable the immediate detection of radiological emergencies affecting the country and will provide important information to authorities for appropriate emergency preparedness and response.

Acknowledgement

This research was supported by 2018 Research fund of KEPCO International Nuclear Graduate School (KINGS), Republic of Korea.

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