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RADIATION BACKGROUND IN THE SOME TOWNS OF UVURKHANGAI PROVINCE IN MONGOLIA

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ABSTRACT

This paper was focused on determination of radiation level around Kharkhorin and Khujirt towns of Uvurkhangai province. We have determined radiation background by radiation survey meters "Atomtex" and "Radi PA-1100(Horiba)". The results were compared with the world and Japanese major cities radiation level.

Keywords: radiation, dose, level, dosimeter, survey meter

INTRODUCTION

UVURKHANGAI AIMAG /PROVINCE/

Territory - 24,286 square miles (62,900 sq. km.)

Center - Arvaikheer town, located 261 miles (420 km.)

from Ulaanbaatar.

Number of somons /towns/- 19

Population 118,400

Figure 1. Map of Uvurkhangai province in Mongolia

Uvurkhangai aimag was established in 1931. Uvurkhangai aimag is located in the central part of Mongolia. The Khangai mountain stretches in the North-West, and the Altai mountain towers in the south-west. The steppe lies in the middle of the territory. The Gobi desert is located in the South. The annual average temperature is around 34° F (1° C), and the average precipitation is about 5 inches (135 mm.). The soil in the south of the area is semi-desert grey and steppe pale areas, in the north part of the area it is mountain type brown and black. 2 percent of the area is covered with poplar, birch, pine, larch forests. There are beautiful oasises with shrubs, cargana, haloxyan, and almond growing everywhere.

Wildlife includes wild sheep, ibex, wild horse, wild camel, gazelle, fox, antelope, snow-leopard, lynx, and birds such as swan, pelican, snow-cock, black grouse, wood grouse. In the province there are majestic mountains like Khyatruun, and plain steppes like Noyokhon Dalai, Arvai, Khar nuden, clear-water rivers such as Ongi, Taath, Orkhon and lakes of Khuis, Tsagaan, Sangiin dalai. The 79 feet (24 m) high waterfall of the Orkhon river (Red Fall), is the major tourist attraction. Amazing places in the province include Khuis eight lakes, Tamchi Yol khad, Yamaatiin Tsant, Khorgoi Khurem, of big and small springs the most famous one is Khujirt, a popular resort. Uvurkhangai is a well-khown tourist destination. Uvurkhangai is a homeland of the ancient Mongolian civilization. There are many ancient monuments, one of them being the Maanit monument with Turk inscription. This monument was erected in 731, CE. Also there are ruins of Kharkhot of Uighur capital city, and ruins of Kharakhorum, former capital of the Mongolian Empire, and Erdene Zuu, the 16th century Buddhist temple. Animal husbandry is the key economic sector. Coal mining, construction materials and wood processing plants are major industrial activities[1].

Kharkhorin (Mongolian: Хархорин) is a town and sum (district) center in Övörkhangai Province in Mongolia. The sum population was 13,828 (1994), 13,964 (2000), and 13,496 (2003). The population of Kharkhorin town itself was 8,977 in 2003 and covered an area of 20.5 km^2.Kharkhorin is located at the lower end of the upper valley of theOrkhon River which is included within UNESCO's World Heritage SiteOrkhon Valley Cultural Landscape. The location marks the easternmost foothills of the Khangai Mountains, where they meet the rolling steppe of central Mongolia[1].

Khujirt. South of Erdene Zuu, Khujirt is a small, soporific town noted for its mineral hot springs and health resort. There's not much else to see here, except for the tiny Gandan Piljeling Khiid, which has a contingent of 15 part-time monks. Most travellers pass through the town en route to the waterfall Orkhon Khiirkhree. There are some interesting grave sites worth looking out for a couple of kilometres out of town on the road to Kharkhorin[1].

The road between Kharkhorin and Khujirt (a bumpy 54km) is one of the best places in the country to see falcons and hawks,particularly the *saraa* (moon) hawk. If you are ever likely to get a photo of one of these birds, this is the place.

In this paper were shown measurement results of dose rate Kharkhorin and Khujirt towns of Uvurkhangai province and compared with radiation level in major cities of the world and Japan. There were taken soil samples from these points and in which will be determined specific radioactivity of 238U, 232Th, 40K and 137Cs in these samples.

RESEARCH METHODS

Figure 2. View of "Atomtex" AT6130 Radiation Survey Meter

For our research we have used "Atomtex AT6130" Radiation Survey Meter / Geiger Counter / Personal Electronic Dosimeter and environmental radiation monitor "PA-1000 Radi (Radi)".

Atomtex AT6130 Radiation Survey Meter / Geiger Counter / Personal Electronic Dosimeter in one. The AT6130 is a compact and robust device intended for Gamma and X-Ray radiation ambient dose equivalent and rate measurements. As well as measurements of beta particle flux density on contaminated surfaces. This Radiation Survey Meter has an inbuilt search mode where the instrument displays in counts per second (cps).

This general purpose Radiation Survey Meter / Geiger Counter / Personal Electronic Dosimeter is well suited to industrial, environmental, security and border control applications[2].

The instrument's operating principle is based on the count rate measurement, generated in the internal Geiger Muller pancake detector. Under the influence of X-Ray, Gamma and Beta

Radiation. The Count rate is converted automatically into Sv values throughout the entire energy range of 20keV to 3MeV. The Microprocessor-based unit is responsible for controlling the radiation monitor operating modes, calculations and displaying the measurement results.

This Radiation Survey Meter / Geiger Counter / Personal Electronic Dosimeter is well suited as a general purpose instrument and represents outstanding quality, functionality, robustness and value for money. The instrument is supplied with a certificate of calibration, user manual and a 12 month warranty. For ordering assistance, technical questions, batch quantities or OEM applications please contact us

AT6130 Radiation Survey Meter Features

- Low weight and small size

- Detects X-Rays and Gamma radiation in the range of 20keV to 3MeV

- 2000 measurement results stored in non-volatile memory

- Multi use instrument, Radiation Survey Meter, Personal Electronic Dosimeter, wipe tester, source search functionality.

- Automatic compensation of intrinsic background levels

- Selective measurement of beta and gamma radiation in mixed fields

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- Measurement results, current time, date and battery life indicator is displayed on LCD screen

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- Measurement results can be transmitted to a PC via Bluetooth interface (If available)

- Headphones can be attached when working in noisy environment

The instrument's operating principle is based on the count rate measurement, generated in the internal Geiger Muller pancake detector. Under the influence of X-Ray, Gamma and Beta Radiation. The Count rate is converted automatically into Sv values throughout the entire energy range of 20keV to 3MeV.

Figure 3. View of Environmental radiation monitor PA-1100 Radi

Figure 4. Measurement result view of Environmental radiation monitor PA-1100 Radi

The Microprocessor-based unit is responsible for controlling the radiation monitor operating modes, calculations and displaying the measurement results.

Environmental radiation monitor PA-1100 Radi (Radi)

The PA-1100 Radi is a communications-capable model in HORIBA's envionmental radiation monitor "Radi" series.

The incorporated communications function allows the new PA-1100 Radi Environmental Radiation Monitor to record automatic data. The PA-1100 Radi measurement ranges expand twice the amount as the PA-1000 Radi while succeeding its usability [3].

Features

Equipped communication functions enable simple data management.

【Bluetooth®】 The radiation doses data from PA-1100 can be recorded together with the GPS data (location and time of import) from a mobile terminal.

【USB】 Continuous monitoring of doses is available by transferring data from USB to a PC.

(Only Japanese version is currelntly available. For the English version please contact HRIBA toll free @ 1-(800) 446-7422.

Expanded measurement ranges: 0.001-19.99μSv/h

Several data linked by PA-1100 and Android™ terminal can be displayed in assorted colors on a map.

※ PC with internet connection is required

Figure 5. View of D-Shuttle dosimeter

Table 1. Characteristic of D-Shuttle dosimeter[4]

Personal cumulative dosimeter (D-shuttle main unit)	
Scope of radiation	Gamma ray
Calibration	Cs-137-ray
Detector	Semiconductor
Erroneous detection	Equipped with erroneous detection prevention function using shock

prevention function	sensor
Measurement range	0.1 μSv to 99.9999 mSv (total cumulative dose)
Dose rate linearity	≦ ±10 % (2 μSv/h to 3 mSv/h)
Alarm	LED blinking in high dose environment
Recording	Dose record per hour
Power supply	Coin type lithium battery (CR2450)
Battery life	Approximately one year (viewing digital readout twice daily)
Measurement record display	Option 1: Download the data to the dedicated PC to display the measurement record. Option 2: Insert the dosimeter into the accessory indicator to display the record.
Size / weight	Approximately 68 mm x 32 mm x 14 mm / 23 grams
Factory setting	Dose set to "0" when shipping

Figure 6. D-Suttle indicator

Table 2. Characteristic of D-Shuttle indicator

	Indicator
Size / weight	Approximately 68 mm x 44 mm x 37 mm / 50 grams
Power supply	Button battery
Display values	Total cumulative dose, number of days, and cumulative dose readout of the previous day

RESULTS AND DISCUSSIONS

The results of the measurements were presented in figures 7, 8 and 9.

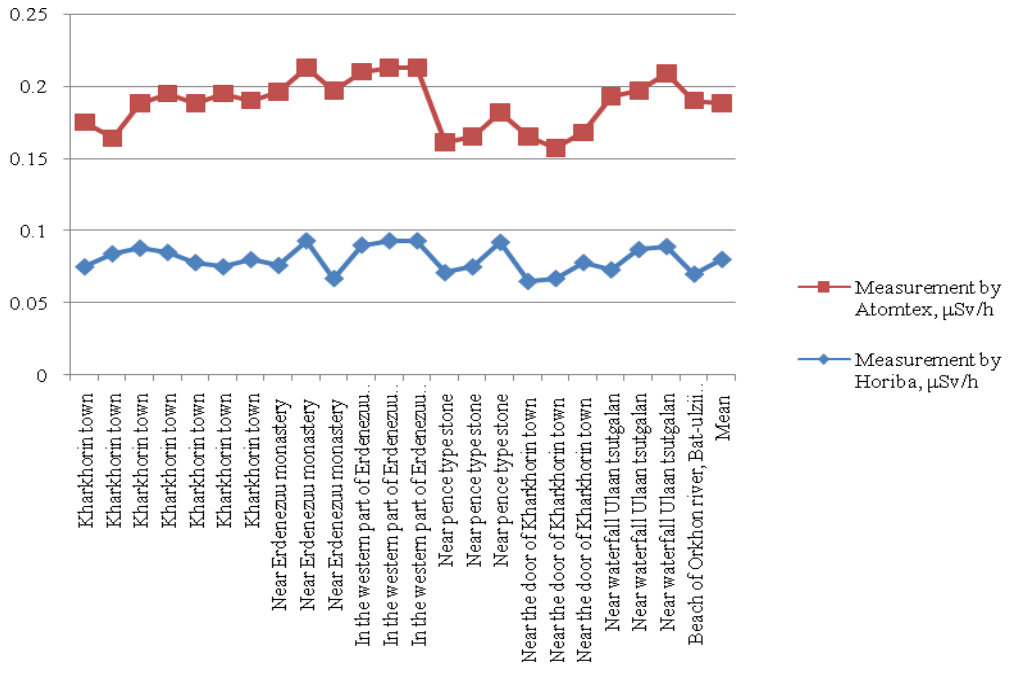

Figure 7. Radiation dose rate around Kharkhorin town of Uvurkhangai province(µSv/h)

From figure 7 we can see that values measured by "Atomtex" survey meter were higher than measured by "Horiba" surveymeter. It depends on survey meter accuracy. Highest value of radiation dose belongs to around Erdene-Zuu monastery and water fall "Ulaan tsutgalan". Measurement results by Horiba survey meter in Kharkhorin town of Uvurkhangai province were in the range 0.065 μSv/h to 0.093 μSv/h and average value was 0.08 μSv/h. Measurement results by "Atomtex" survey meter in Kharkhorin town of Uvurkhangai province were in the range 0.065 μSv/h to 0.08 μSv/h and average value was 0.13 μSv/h.

Measurement results by Horiba survey meter in Khujirt town of Uvurkhangai province were in the range 0.046 μSv/h to 0.111 μSv/h and average value was 0.07 μSv/h. Measurement results by "Atomtex" survey meter in Khujirt town of Uvurkhangai province were in the range 0.11 μSv/h to 0.15 μSv/h and average value was 0.13 μSv/h.

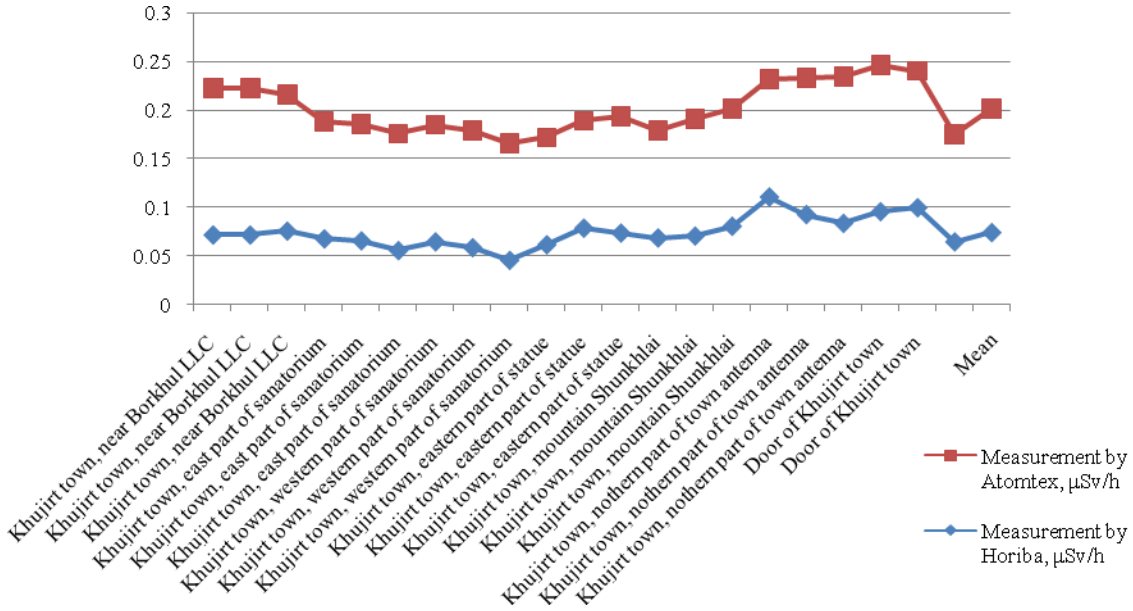

Figure 8. Radiation dose rate around Khujirt town of Uvurkhangai province(μSv/h)

From figure 8 we can see that highest value of radiation dose belongs to around Shunkhlai mountain and door of the Khujirt town.

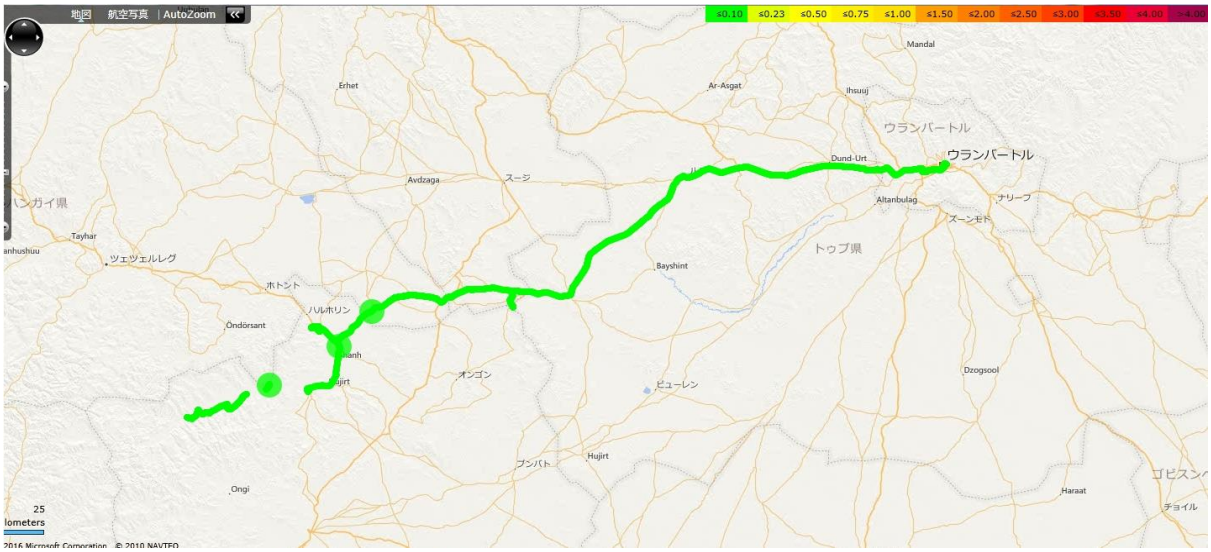

Figure 9. Dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia

From figure 9 we can see that dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia was below than 0.1 µSv/h.

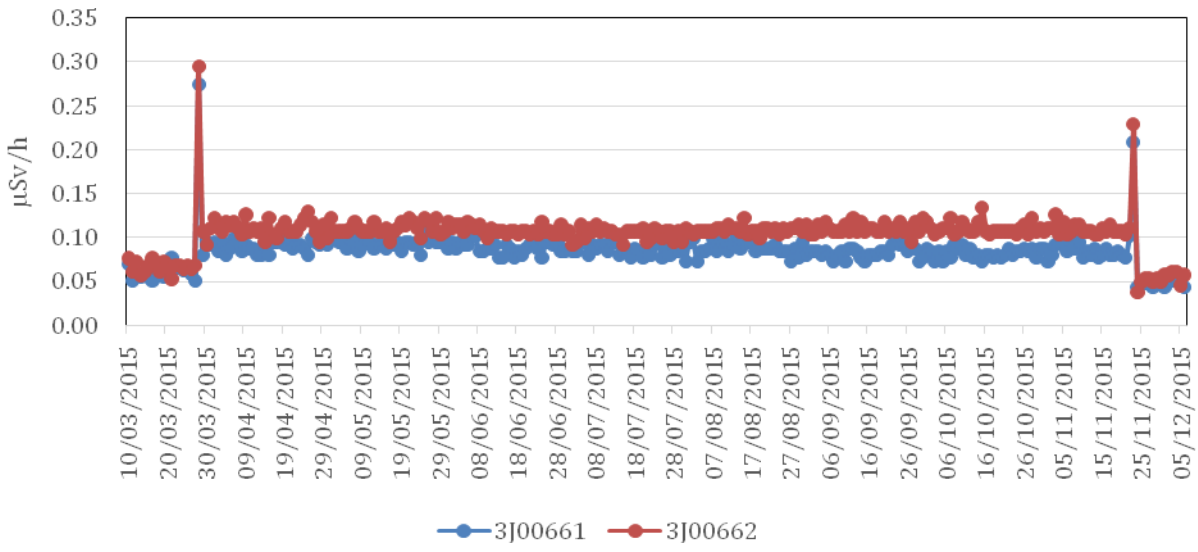

Figure 10. Radiation dose rate measured by D-shuttle dosimeter at MUST and Bayanzurkh district of Ulaanbaatar in period of March 10 to Desember 5, 2015

(3Joo661-at MUST, 3J00662- at Erkhembayar apartment, which located Bayanzurkh district, 7-khoroo, apartment 36G)

From figure10 we can see that radiation dose level in Ulaanbaatar city of Mongolia was higher than radiation dose level in Tsuruga city, Fukui prefecture, Japan.

Figure 11. Radiation levels at major cities in the world and Japan[10]

If we compare Kharkhorin and Khujirt towns' radiation level with the world and Japanese major cities level it was in the range of world major cities radiation level, but higher than Japanese major cities' radiation level.

IV. CONCLUSION

Measurement results by Horiba survey meter in Kharkhorin town of Uvurkhangai province were in the range 0.065 μSv/h to 0.093 μSv/h and average value was 0.08 μSv/h. Measurement results

by "Atomtex" survey meter in Kharkhorin town of Uvurkhangai province were in the range 0.065 μSv/h to 0.08 μSv/h and average value was 0.13 μSv/h.

Measurement results by Horiba survey meter in Khujirt town of Uvurkhangai province were in the range 0.046 μSv/h to 0.111 μSv/h and average value was 0.07 μSv/h. Measurement results by "Atomtex" survey meter in Khujirt town of Uvurkhangai province were in the range 0.11 μSv/h to 0.15 μSv/h and average value was 0.13 μSv/h.

Dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia was below than 0.1 μSv/h.

Radiation dose level in Ulaanbaatar city of Mongolia was higher than radiation dose level in Tsuruga city, Fukui prefecture, Japan.

When we compared Kharkhorin and Khujirt towns' radiation level with world and Japanese major cities level it was in the range of world major cities radiation level, but higher than Japanese major cities' radiation level.

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