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Radiation Level in Western Part of Mongolia

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Abstract: ***This paper was focused on determination of radiation level in some towns of western part of Mongolia. We have determined radiation dose rate by radiation surveymeters "Atomtex", "Horiba PA-1100 Radi" and "Soeks eco tester". The results were compared with the world and Japanese major cities radiation level.***

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

1. Introduction

Mongolia is a landlocked country in East Asia. Its area is roughly equivalent with the historical territory of Outer Mongolia, and that term is sometimes used to refer to the current state. It is sandwiched between Russia to the north and China to the south, where it neighbors the Inner Mongolia Autonomous Region. Mongolia does not share a border with Kazakhstan, although only 37 kilometers (23 mi) separates them.

At 1, 564, 116 square kilometers (603, 909 sq mi), Mongolia is the 18th-largest and the most sparsely populated sovereign state in the world, with a population of around three million people. It is also the world's second-largest landlocked country behind Kazakhstan and the largest landlocked country that does not border a closed sea. The country contains very little arable land, as much of its area is covered by grassy steppe, with mountains to the north and west and the Gobi Desertto the south. Ulaanbaatar, the capital and largest city, is home to about 45% of the country's population. Ulaanbaatar also shares the rank of the world's coldest capital city with Moscow, Ottawa, and Nur-Sultan.

Approximately 30% of the population is nomadic or semi-nomadic; horse culture is still integral. The majority of its population are Buddhists. The non-religious population is the second largest group. Islam is the dominant religion among ethnic Kazakhs. The majority of the state's citizens are of Mongol ethnicity, although Kazakhs, Tuvans, and other minorities also live in the country, especially in the west. Mongolia joined the World Trade Organization in 1997 and seeks to expand its participation in regional economic and trade groups.

The area of what is now Mongolia has been ruled by various nomadic empires, including the Xiongnu, the Xianbei, the Rouran, the Turkic Khaganate, and others. In 1206, Genghis Khan founded the Mongol Empire, which became the largest contiguous land empire in history. His grandson Kublai Khan conquered China to establish the Yuan dynasty. After the collapse of the Yuan, the Mongols retreated to Mongolia and resumed their earlier pattern of factional conflict, except during the era of Dayan Khan and Tumen Zasagt Khan.

In the 16th century, Tibetan Buddhism began to spread in Mongolia, being further led by the Manchu-founded Qing dynasty, which absorbed the country in the 17th century. By the early 1900s, almost one-third of the adult male population was Buddhist monks. After the collapse of the Qing dynasty in 1911, Mongolia declared independence, and achieved actual independence from the Republic of China in 1921. Shortly thereafter, the country came under the control of the Soviet Union, which had aided its independence from China. In 1924, the Mongolian People's Republic was founded as a socialist state.[19] After the anti-Communist revolutions of 1989, Mongolia conducted its own peaceful democratic revolution in early 1990. This led to a multi-party system, a new constitution of 1992, and transition to a market economy [1].

In this paper were shown measurement results of dose rate in some towns of Mongolia and compared with radiation level in major cities of the world and Japan.

2. 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
- Measurement results, current time, date and battery life indicator is displayed on LCD screen
- Measurement results can be transmitted to a PC via Bluetooth interface (If available)
- Headphones can be attached when working in noisy environment

Figure 3: View of "Soeks ecotester" Radiation Survey Meter

Most of the accurate micro-Sieverts (uSv) personal radiation meters are very expensive. But we provide the quality Ecotester 2-in-1 features of Radiation Detector and Nitrate Food tester with high accuracy at a reasonable rate. This device helps to easily monitor radiation exposure and also helps to eliminate a food which contains excess chemicals from your diet.

EcoTester SOEKS helps to find out the Radiation Exposure and also provide the reading of Gamma and Beta ionized Radiation. These radiations are very harmful to human health, cause cancer, and damage DNA. You can easily run the EcoTester V2 through 24/7 USB cable. It also acts as a Geiger counter warning device, which gives the audio and video alert when the radiation level increases around the environment.

Eco Tester is also used as a Nitrate Tester. Insert the metal probe in the fruits, processed meat to find out the Nitrates and sodium nitrate levels or potassium nitrates and nitrites where the food company uses the cured meat to preserve its appearance and color also prevents the fats from going rancid and avoid the bacterial growth. The food which shows high levels of nitrates when it undergoes the chemical preservatives, synthetic pesticides or rodent poisons. This nitrates presence indicates that food should not be used. But the organically grown food shows only the fewer amounts of nitrates based on the grower. Nitrate causes severe issues to the babies which lead to cause Blue Baby Syndrome.

The effects of the nitrates cause food allergies, asthma, gallstones, hepatitis, low stomach acid, raw foodists alike, and many other medical issues to the people. The specially designed Ecotester 2-in-1 Radiation Detector and Nitrate food Tester will provide you with a list of foods which contains excess nitrates and also send you the audio and video alerts. So you can easily find out the healthy foods.

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

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 environmental 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].

3. Results and Discussions

The results of the measurements were presented in tables 3, 4 and figures 7 and 8.

Table 3. Radiation dose rate around Kharkhorin town of Uvurkhangai province/Measured by Atomtex survey meter/

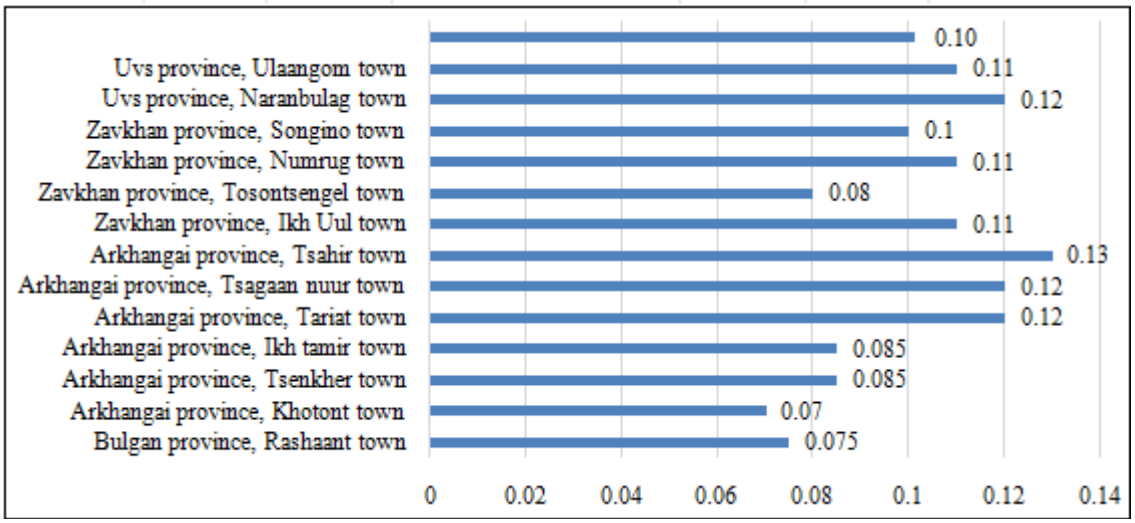

Figure 4: Radiation dose rate in some towns of Mongolia (µSv/h)

In figure 4 highest value of radiation dose rate belongs to Tsahir town of Arkhangai province. Lowest value belongs to Khotont town of Arkhangai province.

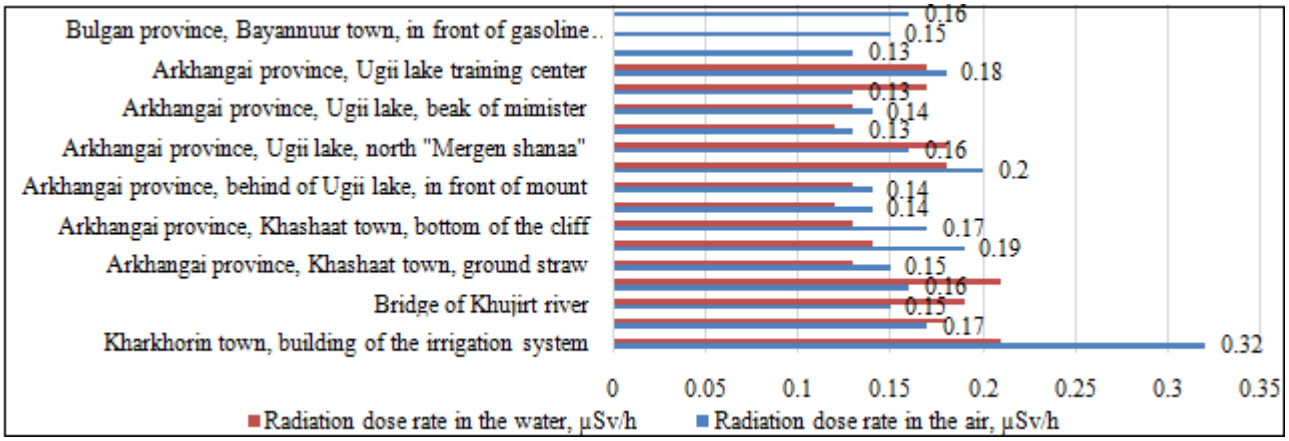

Figure 5: Radiation dose rate in the air and water of some towns in Mongolia (μSv/h)

In figure 5 highest value of air radiation dose rate belongs to building of irrigation system in Kharkhorin town of Arkhangai province. Lowest value belongs around Ugii lake of Arkhangai province. Highest value of water radiation dose rate belongs to Khashaat town of Arkhangai province and lowest belongs to around Ugii lake of Arkhangai province [3-9].

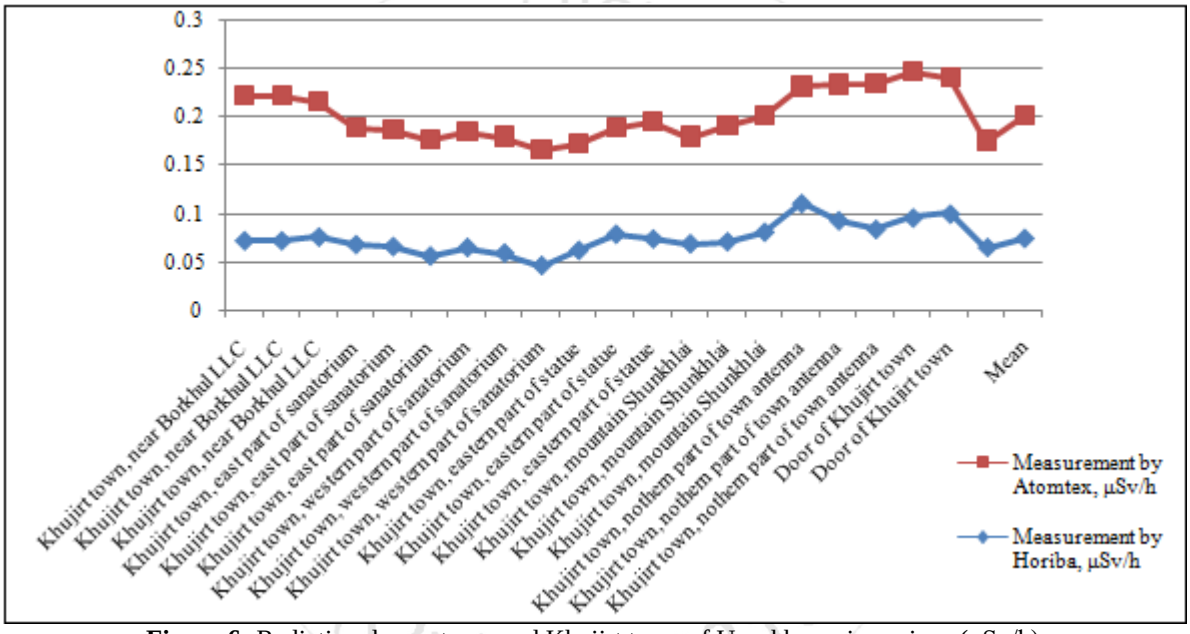

Figure 6: Radiation dose rate around Khujirt town of Uvurkhangai province (μSv/h)

In figure 6 we can see that highest value of radiation dose belongs to around Shunkhlai Mountain and door of the Khujirt town.

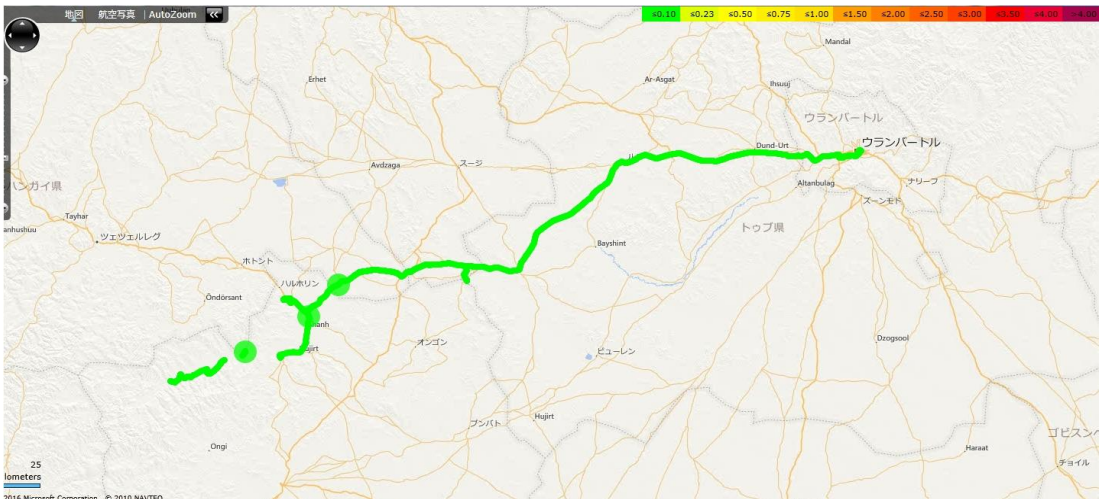

Figure 7: Dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia

In figure 7we can see that dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia was below than 0.1 μSv/h.

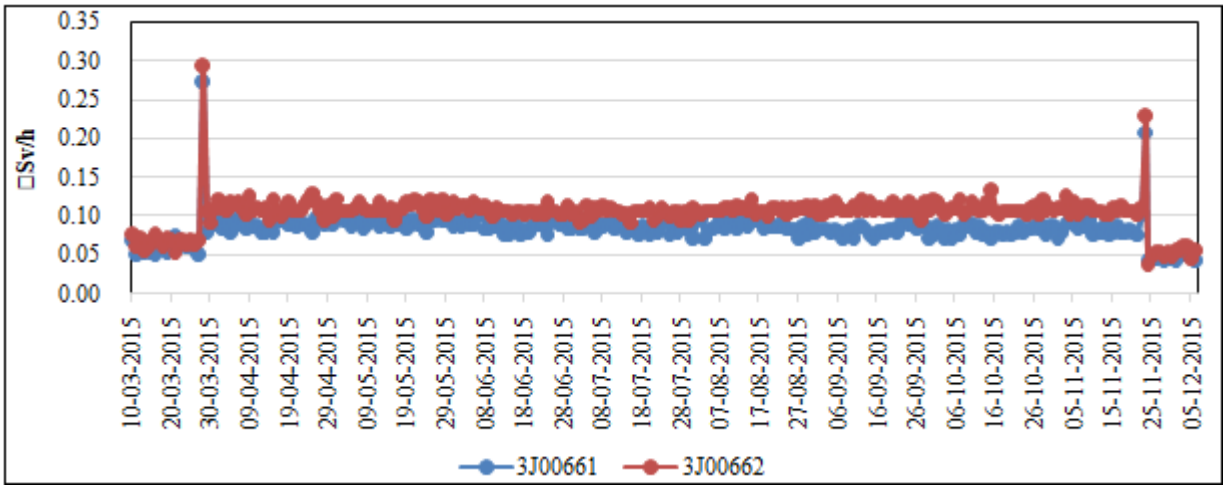

Figure 8: Radiation dose rate measured by D-shuttle dosimeter at MUST and Bayanzurkh district of Ulaanbaatar in period of March 10 to December 5, 2015
(3Joo661-at MUST, 3J00662- at Erkhembayar apartment, which located Bayanzurkh district, 7-khoroo, apartment 36G)

In figure 8 we can see that radiation dose level in Ulaanbaatar city of Mongolia was higher than radiation dose level in Tsuruga city, Fukui prefecture, Japan.

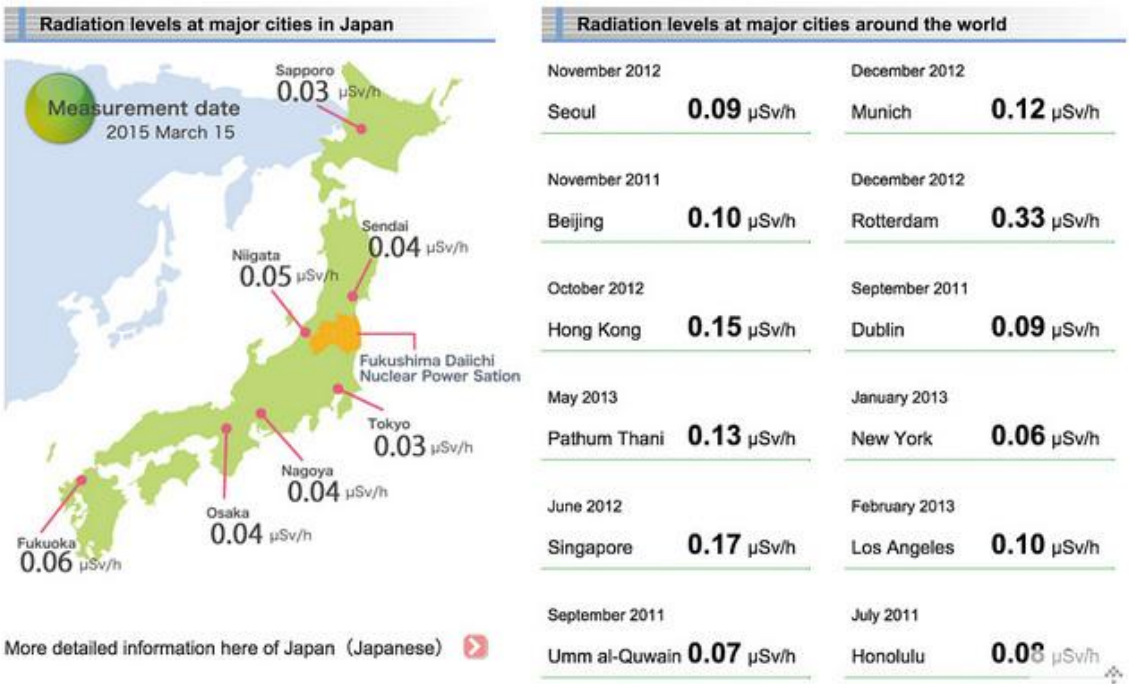

Figure 9: Radiation levels at major cities in the world and Japan [10]

If we compare above 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.

4. Conclusion

1) 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.
2) 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.
3) Dose rate on the road from Ulaanbaatar to Kharkhorin and Khujirt towns of Mongolia was below than 0.1 μSv/h.

4) Radiation dose level in Ulaanbaatar city of Mongolia was higher than radiation dose level in Tsuruga city, Fukui prefecture, Japan.
5) When we compared some towns' radiation level of western part in Mongolia 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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