# Radio-Ecological Situation in Rustavi and Oncological Morbidity of Population

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***ABSTRACT***

Radio-ecological situation and oncological morbidity in Rustavi was investigated. An average indicator for open spaces is equal to 69.8±1.12 nGy/h. This figure corresponds to the relatively high level registered by the NRPB. Taking into account conditions in Georgia (geographic location and geophysical situation) this could be considered quite normal. An average RB indicator for buildings in Rustavi is 132±1.56 nGy/h, slightly exceeding the same type of radiation indicator in European countries. According to the results a mean annual dose of external radiation of population (20% from open spaces and 80% from buildings) is 1.04±0.13 mZv/y. This figure is higher than indicators registered in most European counters. On the basis of our data and the data obtained from the National Center of Oncology of the Ministry of Labor, Health and Social Security we have undertaken contraposition of oncological morbidity indicators of Rustavi population with radio-ecological situation in Rustavi.The results of the study demonstrate that the oncological morbidity indicators for Rustavi population (incidence, prevalence, mortality) in 2002 are lower than the same indicators for Tbilisi, despite the fact that in both cities (Rustavi, Tbilisi) the average annual dose of radiation population is exposed to is almost the same – 1.04 and 1.07 mZv/y (respectively).

***KEYWORDS:*** *radiation background (RB), ionizing radiation (IR), radiobiological effects, radioecological situation, oncological morbidity*

Contamination of the environment with ionizing radiation (IR) sources is crucially important for the evaluation of ecological situation in any of the regions. Radiobiological effects (somatic, teratogenic, carcinogenic and genetic) caused by high dose IR are studied well; whereas there are not enough data available on changes in human body caused by low dose IR. Moreover, some of these data are mutually exclusive. It is known from the literature that the lowest dose of IR is harmful for the human organism. Harmful impact primarily means the development of malignancies and genetic defects [2,4,6,7,10,11].

The disaster at Chernobyl Power Plant resulted in radioactive contamination of the whole European territory of the former Soviet Union. Georgia occupied fourth place among the most contaminated countries next to Byelorussia, Ukraine and western regions of Russia [2,5,8,12].

Recent statistical analysis has revealed increased morbidity of Georgian population, in particular, increase of oncological and genetic disorders and thyroid diseases [1,3,12].

Epidemiological studies have identified the risk of tumor development in population exposed to radiation. Meanwhile, the risk is higher in cases of exposure to high dose radiation rather than to low doses. It is also identified that the effects of radiation background (RB) may cause 2-5% of malignant tumors. [4].

Goal of the study is to discover interrelations between oncological morbidity of Rustavi population and radio-ecological situation in Rustavi.

## *MATERIALS AND METHODOLOGY*

RB was measured by means of unified methodology using specially developed instructions; identical equipment was used for measurements (СРП -68-01).

Multiple measurements were performed in each point (10 readings). All data were recorded in special registration books. 33 open places (330 readings) were investigated together with 110 points in the buildings with different functions (1110 readings in total).

Initial data were processed by means of Windows system Microsoft Excel and Math & Statistic software.

Information on oncological morbidity of Rustavi population was provided by the Department of Statistics of the National Center of Oncology, the Ministry of Labor, Health and Social Security of Georgia.

## *RESULTS*

RB of open places in Rustavi is within the range of 59.7+1.05 - 79.5+1.27 nGy/h; an average indicator is 69.8+1.12 nGy/h.

RB index for enclosed spaces in Rustavi is within the following range: 122.0+1.48 - 141.0+1.64 nGy/h; an average indicator is 132.0+1.56 nGy/h.

RB index for open spaces is lower compared to the RB for enclosed spaces. This is quite normal, as the intensity of radiation is affected by radionuclid composition of construction materials.

RB was measured in buildings with various functionalities. Relatively high indicators were registered in industrial constructions - 142.3+1.93 nGy/h; next to them are general-purpose buildings - 127.9+1.06 nGy/h. There is an insignificant difference between the RB indicators of Children's institutions/schools and public buildings and these indicators are equal to 122.3+0.71 nGy/h and 122.5+0.51 nGy/h respectively.

Measurement of RB was undertaken in spaces (rooms) with different functionality. It should be mentioned that the difference of the RB indicators in spaces with different functionality are insignificant. Relatively high indicator was registered in the entrance halls of industrial buildings - 145.4+2.29 nGy/h, where floors are mainly decorated with marble; high indicators registered in bathrooms - 140.5+1.02 nGy/h - might be explained with radionuclid composition of glazed tile and flooring tile. Relatively low figures are registered in bedrooms - 120.9+0.47 nGy/h; this is explained by good ventilation and enough space.

RB indicators for enclosed spaces were evaluated considering composition of construction materials. Building block is the most widely used construction material. The lowest indicator of RB is 114.8+1.48 nGy/h, the highest -

132.2+1.64 nGy/h, an average indicator - 123.2+1.56 nGy/h.

Evaluation of the RB considering roofing of buildings demonstrated that relatively high mean indicator was registered in the buildings roofed with tile - 144+1.12 nGy/h; relatively low mean indicator was registered in the buildings with slated roofs (asbestos sheeting) - 120.9+0.6 nGy/h.

Evaluation of RB considering flooring materials showed that in the buildings with wooden, concrete, mosaic and stone floors RB indicators are almost the same - 124.9+1.05 - 146.8+0.39 nGy/h.

***RESULTS AND DISCUSSION***

Mean RB indicator for open spaces in Rustavi is 69.8+1.12 nGy/h. According to the data of the National Radiological Protection Board (NRPB) (9) RB of open spaces in European countries is within the range of 30-80 nGy/h. It is clear, that RB index on the investigated territory of Georgia corresponds to the relatively high level of NRPB indicators. Taking into account conditions in Georgia (geographic location and geophysical situation) this could be considered normal.

According to the NRPB data RB of buildings in European countries vary within the range of 50-80 nGy/h and more. In Rustavi mean indicator for buildings is 132+1.56 nGy/h; this figure slightly exceeds the RB indicator for European countries.

According to the NRPB data mean annual doses from natural radiation sources in European countries is within the range of 2-8 mZv/y. Radon plays the most important part in formation of a radiation dose; it is followed by radiation inside buildings, cosmic and open space radiation. Radiation dose without Radon is about 0.6-0.8 mZv/y.

According to our data a mean annual dose of external radiation of population (20% from open spaces and 80% from buildings) in Rustavi is 1.04+0.13 mZv/y. This figure is higher than indicators registered in most European counters.

On the basis of our data and the data obtained from the National Center of Oncology of the Ministry of Labor, Health and Social Security we have undertaken contraposition of oncological morbidity indicators of Rustavi population with radio-ecological situation in Rustavi.

The table demonstrates that in 2002, when the RB in Rustavi was measured, the incidence of oncological diseases (100.5) was lower by 32.2 units compared to the same indicator for Tbilisi.

In 1996-98-99 intensive morbidity rate for Rutavi is more than the same indicator for Tbilisi (by 6.06, 1.4 and 11.02 units respectively).

In the investigated 10 years interval, excluding 1996-98-99, all indicators for Rustavi are lower compared to Tbilisi indicators (*Fig.1*).

Prevalence of oncological diseases per 100 000 population in Rustavi is less than the same indicator for Tbilisi (*Fig.2*).

In 2002 intensive mortality rate in Rustavi was lower by 41.79 units compared to the results registered in Tbilisi. Intensive mortally rate of oncological patients was the highest in 1996 (72.0), i.e. less by 7.99 units than the same indicator for Tbilisi (*Fig.3*).

The results of the study demonstrate that the oncological morbidity indicators of Rustavi population (incidence, prevalence, mortality) in 2002 is lower than the same indicators for Tbilisi, despite the fact that in both cities (Rustavi, Tbilisi) the mean annual dose of radiation population is exposed to is almost the same - 1.04 and 1.07 mZv/y.

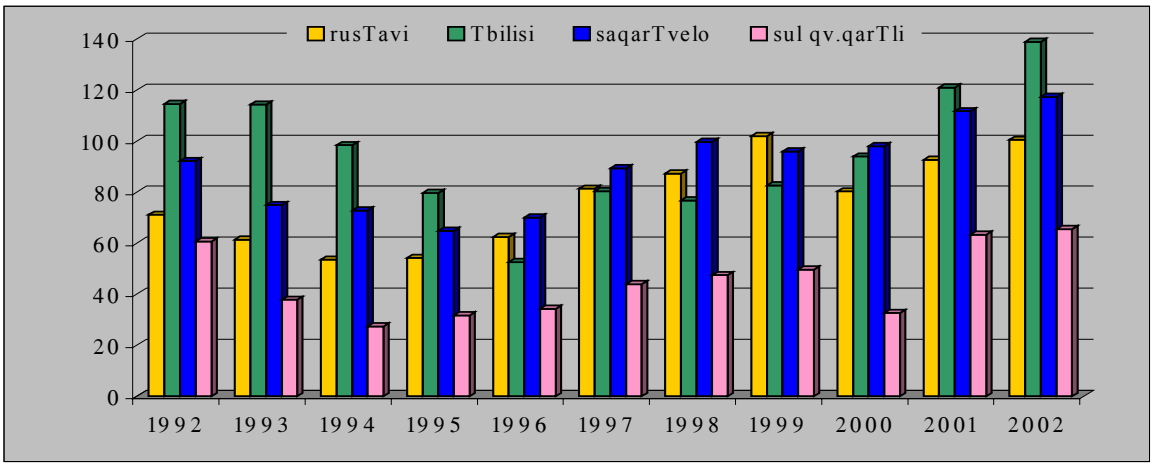


***Fig.1*** *Incidence of oncological diseases in Rustavi.*

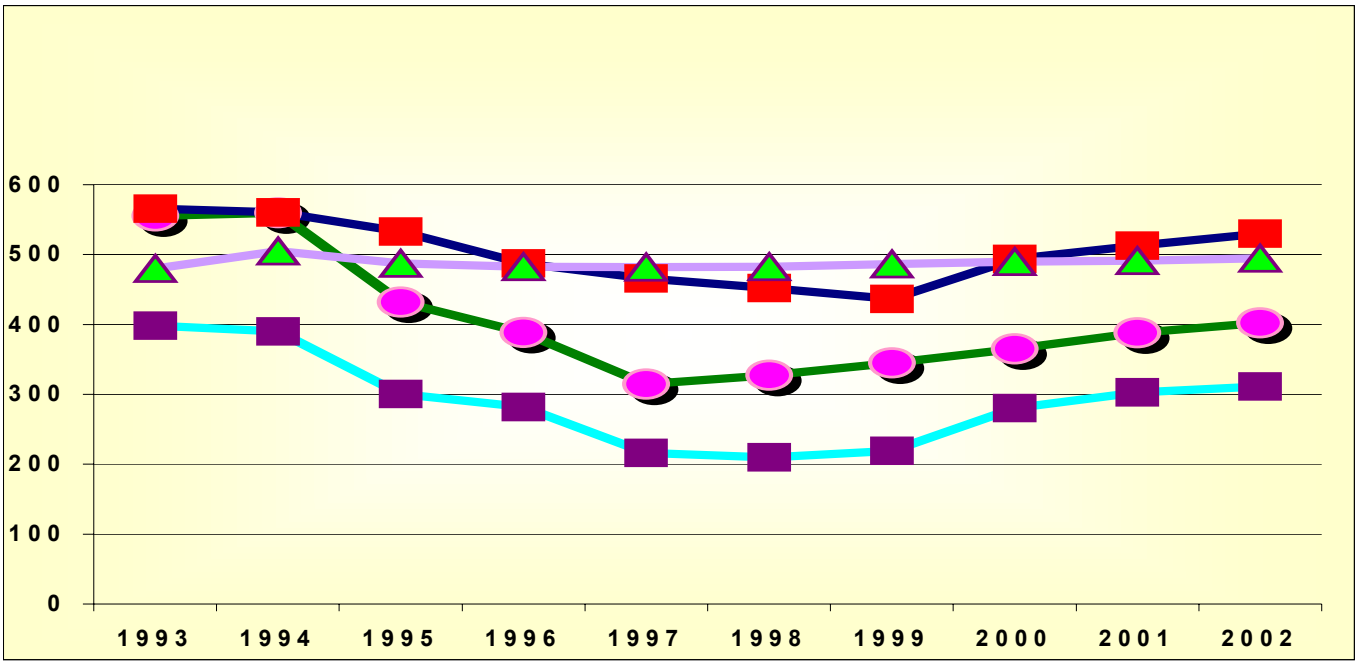


**Fig.2** *Prevalence of oncological diseases in Rustavi.*

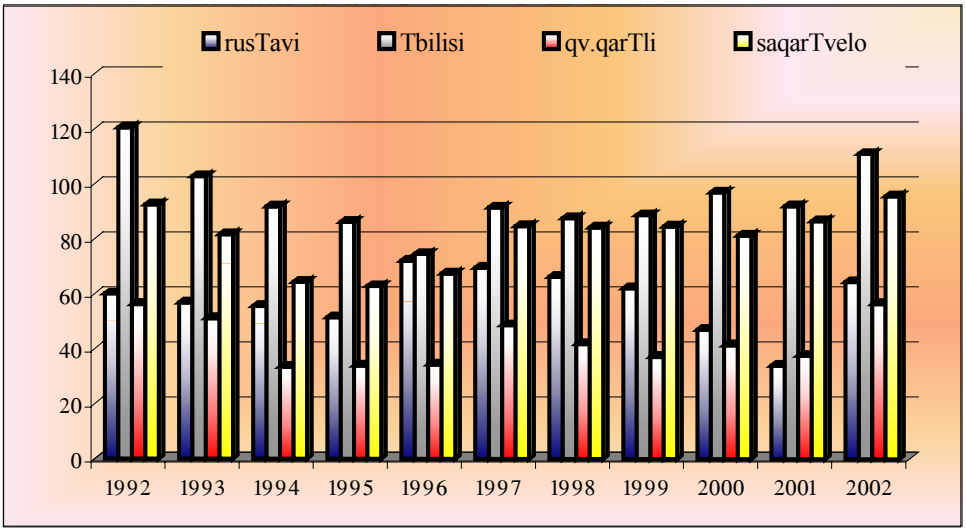


**Fig.3** *Oncological mortality rate in Rustavi.*

Therefore, it is impossible to find correlation between the RB indicators and oncological morbidity. The rise of the RB after the disaster at Chernobyl Power Plant might have triggered the development and manifestation of oncological diseases; nevertheless, it could not be considered the only reason for the elevation of oncological morbidity rate, as the combined effect of various minor hazards may also play the role in the development of oncological diseases.

## *CONCLUSION*

Radio-ecological situation and oncological morbidity in Rustavi was investigated. An average indicator for open spaces is equal to 69.8+1.12 nGy/h. This figure corresponds to the relatively high level registered by the NRPB. Taking into account conditions in Georgia (geographic location and geophysical situation) this could be considered quite normal.

An average RB indicator for buildings in Rustavi is 132+1.56 nGy/h, slightly exceeding the same type of radiation indicator in European countries.

According to the results a mean annual dose of external radiation of population (20% from open spaces and 80% from buildings) is 1.04+0.13 mZv/y. This figure is higher than indicators registered in most European counters.

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***REFERENCES:***


1. Gelashvili K., Vepkhvadze N., Sekhniashvili G., Moistsrapishvili M. Impact of radiation background and prevalence of goiter in Western Georgia // Sakartvelos Sameditsino Moambe - 1998. #4-5-6. Pages 11-16.
2. Gelashvili K. Problems of radiation safety of Georgian population // Sakartvelos Sameditsino Moambe. - Tb., 1997. #1-2-3. Pages 3-9.
3. Epidemiological Bulletin. Endemic goiter - the problem of Public Health // Ministry of Health of Georgia. - 1996. #4. V. 1. - pages 95-99.
4. Vepkhvadze N. Changes caused in the body by low-dose ionizing radiation, forecast of expected adverse reactions and development of appropriate preventive measures: Dis. ... Doctor of Med Sciences. - Tb., 1995. - page 210.
5. Mosulishvili N., Shonia N., Katamadze N., Ginter M. Some data of radio-ecological monitoring undertaken in Georgia after Chernobyl disaster // Radiation research. - 1991. #6. pages 221-241.
6. UN SCEAR Report 1988. New-York, 1988. - page 647.
7. UN SCEAR Report 1977-1978. New-York, page 382.
8. Nadareishvili N., Tsitskishvili L., Kirtadze S., Manjgaladze D. et al. Impact of Chernobyl disaster on radio-ecological situation in the South Caucasus. Report 1. Chernobyl radionuclid echo in Georgia // Radiation research. V.6 - Tbilisi. - 1991. - pages 158-165.
9. National radiation maps of Western Europe. National Biological Protection Board (NRPB) 1993/
10. Pospishil M., Vakha I. Individual radio-sensitivity, its mechanisms and manifestations. - M.: Energoatomizdat, 1986, - page 10.
11. Radiation protection. Publication ICRP -26, 1976 - Atomizdat. -1978. - page 87.
12. Tsitskishvili M. Results of radio-ecological monitoring in the South Caucasus. Dis. ... Doctor of Med Sciences. - Obnynsk. 1993. - page 250.


# Радиоэкологическая ситуация и онкологическая заболеваемость в г. Рустави

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## Р Е З Ю М Е

Изучена радиоэкологическая ситуация и онкологическая заболеваемость в г. Рустави. Средний показатель радиационного фона (РФ) для закрытых помещений составляет 69.8+1.12 нгр/час., что соответствует сравнительно высокому уровню РФ, зарегистрированному Международной комиссией по радиологической защите (МКРЗ), В условиях Грузии, принимая во внимание ее географическое расположение и геофизическое состояние, этот показатель можно считать нормальным. Средний показатель РФ для зданий Рустави составляет 132+1.56 нгр/час, что незначительно выше аналогичного радиационного показателя для европейских стран. Согласно полученным результатам средняя годовая доза внешнего облучения населения (20% из открытых помещения и 80% - из зданий) составляет 1.04+0.13 м$^3$в/г, т.е. незначительно выше показателей, зарегистрированных в большинстве стран Европы. На основе собственных данных и данных, полученных из Национального онкологического центра Министерства труда, здравоохранения и социальной защиты Грузии, мы провели сопоставление показателей онкологической заболеваемости в г. Рустави с состоянием радиоэкологической ситуации. Установлено, что показатели онкологической заболеваемости населения г. Рустави (инцидентность, превалентность, смертность) в 2002 г. ниже аналогичных показателей, зарегистрированных в г. Тбилиси, несмотря на то, что как в Рустави так и в Тбилиси среднегодовая доза облучения населения примерно одинакова, составляя 1.04 и 1.07 м$^3$в/г соответственно.

***КЛЮЧЕВЫЕ СЛОВА:*** *радиационный фон (РФ), ионизирующее излучение (ИИ), радиобиологические эффекты, радиоэкологическая ситуация, онкологическая заболеваемость*