

Risk assessment of thyroid cancer incidence among population due to residence close to Mayak PA

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Preface: It is well known that gas-aerosol emissions from the pipes of nuclear reactors and irradiated fuel disposal plants are the main source of I^{131} pollution of the environment [1]. Due to this fact assessing the risk of health effects, primarily cancer, among the populations residing close to atomic production facilities that used to be a source of radioactive pollution of adjacent areas exceeding the background level is still a topical problem [2].

Topicality of cancer incidence studies among the residents of Ozyorsk, as the nearest settlement to Mayak PA, is supported by the fact that uncontrolled gas-aerosol emissions to the atmosphere from the pipes of production reactors and of radiochemical plant took place in the initial years of operation of the enterprise. It was stated that I^{131} was the main dose-forming radionuclide in release composition [3]; I^{131} was produced in the course of reprocessing of irradiated uranium lumps. Radioactive iodine was released to the atmosphere with gas-aerosol emissions through air systems of the radiochemical plant that lead to radiation pollution of the adjacent areas including Ozyorsk. In [4] it is demonstrated that the total volume of I^{131} released to the atmosphere with gas-aerosol emissions through the pipes of the radiochemical plant made 1.0 million Ci, 90% of that volume was released in 1948–1954.

In earlier studies it was demonstrated that increased incidence of thyroid cancer is the only reliable health effect among the population that used to reside in the city in childhood [5].

Purpose: Thyroid cancer incidence rates in the population residing as children in areas contaminated by radioactive gas-aerosol emissions during technological development at Mayak PA were assessed in the current epidemiological study.

Material and methods: The study was carried out in a cohort of 31,836 people residing in childhood in Ozyorsk during 1948–1962. In that period uncontrolled gas-aerosol emissions from chimneys of radiochemical plants took place. There were 60 thyroid cancer cases diagnosed and histologically verified in the study cohort. Standardized incidence rates (SIR) was estimated by the indirect standardization by age and sex with a 95% confidence interval. Age- and sex-related thyroid cancer incidence rates in Russia and among the urban population of Chelyabinsk were chosen as a standard. Information on radiation exposure levels of thyroid for Ozyorsk residents of different ages was obtained on the basis of preliminary dose calculations for two scenarios of food consumption from different

suppliers. Radiation excess relative risk per unit dose (ERR/Sv) was calculated using a Poisson regression model implemented in Amfit module of the Epicure software.

Results: SIR of thyroid cancer in the cohort was 3.16 among men (1.68–5.06) and 2.07 (1.52–2.65) among women compared to the data of national statistics. Significant difference of thyroid cancer incidence in the cohort compared to the regional statistics was also found: SIR was 2.04 (1.08–3.26) among men and 1.59 (1.17–2.04) among women. ERR/Sv was -0.03 ($p>0.5$), i.e. increase of thyroid cancer incidence in the study cohort is not associated with the obtained estimates of equivalent doses to the thyroid.

Conclusion: In the cohort of persons residing as children in Ozyorsk in the period of uncontrolled gas-aerosol emissions from the chimneys of radiochemical plants in 1948–1962, age- and sex-related thyroid cancer incidence rates and relative risk of thyroid cancer incidence in men and women significantly (2–3 times) exceeded those in the national and regional statistics. The correlation between dose and effect was not observed. It could be associated with using group doses due to lack of individual doses.

References

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