

Current radiation risks from occupational exposure in Russian nuclear industry

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For monitoring risks of occupational radiation exposure to workers of Russian nuclear industry the system ARMIR is used. The system was developed at the State Corporation ROSATOM in cooperation with the Russian Scientific Commission on Radiological Protection and the National Radiation Epidemiological Registry [1-3].

The ARMIR system is designed on the basis of principles and methods for calculation of radiation risk recommended by ICRP [4]. During the creation of the system algorithms of calculation of different radiation risk measures from multiple radiation exposure, specialized software and database were developed. Justification of adaptability of mathematical models based on follow-up data on A-bomb survivors in Japan to Russian conditions was carried out.

The system ARMIR was first used in the “Mayak Production Association” in 2006. At present the system is used in more than 100 radiation and nuclear hazardous sites of the ROSATOM.

ARMIR databases consist all information necessary for calculating radiation risks, that is employee’s ID number, gender, date of birth, as well as annual radiation doses received by a regulatory monitored worker being registered on a database maintaining records of the doses received by each individual dosimeter wearer. More than 60 thousand personal records are collected annually (Table 1).

Table 1. Basic characteristic of occupational radiation exposure in main divisions of the Rosatom.

Division	Number of workers	Average age, years	Average annual dose, mSv	Average cumulative dose, mSv	Average length of work, years
Electric power division	27427	42.0	1.77	51.2	12.4
Fuel division	7637	43.7	1.20	19.7	11.1
Nuclear weapons complex	5131	38.5	3.39	30.8	5.8
Mining division	13959	42.9	1.82	31.4	11.9
Nuclear and radiation safety complex	3334	45.1	1.05	31.0	14.1
Innovation management unit	4578	48.3	2.17	41.2	14.9
ROSATOM	62349	42.8	1.83	39.3	11.9

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During the recent years average risk value does not exceed 0.00008 (Table 2).

Table 2. Results of monitoring radiation risks in main ROSATOM divisions.

Division	Average individual risk	Average Safety Index of Potential Exposure, %
Electric power division	1.2E-04	67.2
Fuel division	3.1E-05	76.5
Nuclear weapons complex	5.0E-05	65.0
Mining division	2.0E-05	48.0
Nuclear and radiation safety complex	6.8E-05	76.9
Innovation management unit	1.0E-04	67.2
ROSATOM	7.9E-05	67.0

Data accumulated in the ARMIR are used for calculation of the Safety Index of Potential Exposure, SIPE. The index takes into account limitation of annual generic risk value, $< 2 \cdot 10^{-4}$. This allows monitoring radiation protection at ROSATOM facilities with regard to sources of potential exposure. The level of radiation protection at a nuclear facility in relation to sources of potential radiation exposure is considered as optimized if the SIPE is above 50% and does not reduce with time. Average safety index of potential radiation exposure in ROSATOM achieves 67%.

Information on existing radiation risks in nuclear industry is brought to the notice of professional association and interested public via ROSATOM Annual Public Report and industry-specific mass media.

Estimation of existing radiation risks and their prediction are used for making managerial decisions in relation to radiation exposure and radiation protection of workers. The estimates should be taken into account when planning accident rescue operations and setting up emergency teams.

References

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