

The Russian State System for Quality Assurance of Radiation Measurements

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The State system for ensuring quality of radiation measurements (hereinafter referred to as "System") has been establishing in Russia throughout a long period of time. When arranging the System, any measurements of physical quantities and parameters, which characterize sources and fields of ionizing radiations, were considered as the radiation measurements (RM).

The System has some distinguishing features caused by the factors which are basically characteristic for this field of measurements made in Russia.

The first factor resides in the fact that in Russia, the RM are currently central problems because of a great number of installations where the ionizing radiations exhibit activity. Among them there are radiochemical enterprises, atomic power plants, research reactors, Navy and Civil fleet with atomic engines, radionuclide diagnosis, radiation therapy etc.

The second factor is a great variety of the RM types, stemming from a large number of physical quantities and parameters: specific activity - with numerous radionuclides being measured, the flux and flux density of the charged particles and neutrons - within a wide range of energy, power of the absorbed and equivalent doses - within a wide power range for different types of radiations etc., as well as from a number of problems, the solution of which require such measurements as: technological (at the enterprises and plants), diagnostic (in medicine and manufacture), radioecological (at monitoring laboratories) and so on.

The third factor consists in the necessity to conduct quite often the RM for economic subjects such as atomic power plants or ecology organizations which have the same interests and should come to some responsible conclusions related to the fate both of manufacture and of population.

To satisfy the above requirements, the System should be arranged in such a manner that it could be used as an objective basis for solution of any problems including the disputable ones which refer to the RM.

Thus, from the very beginning, the System has been created with the aim to provide the metrological assurance of all economy branches of Russia in the field of the RM, using as a basis the centralized principle which means:

- reproduction of measurement units which are the main ones for a given field of measurements with the help of state standards;
- the legalized hierarchy chart for calibration of measuring means with an approved list of secondary and working standards and definite intercalibration intervals;
- availability of specifications regulating methods and accuracy limits of measurements for the whole park of the working measuring means being in usage.

At present the System is based on 11 state primary and special standards which provide to reproduce the main measurement units for the activity of radionuclides in sources, gases, aerosols, flux and flux density of the charged particles and neutrons, power of the absorbed dose of photon, neutron and beta-radiation as well as some other measurement units.

The size of the units reproduced by the standards is transferred to the working

measuring means according to the hierarchy calibration charts including more than 50 working standards operating in the form of suitably designed dosimetry and radiometry set-ups installed at the leading enterprises or at the main metrological laboratories. As the certified radiation sources, they use radionuclide sources, x-ray apparatus, reactor channels, output accelerator beams. All measuring means including working standards, are tested every 3-5 years, the same interval being used for metrological certification of the measurement methods.

The System described, which to some extent appears to be bulky, has demonstrated its efficacy in carrying out the works on liquidation of consequences of the accident at the Chernobyl Atomic Power Plant.

First of all, it was found to be very important that all radiometers and dosimeters being used at the accident site, had been calibrated in the established units and that the measurements were performed according to the specified procedures. This enabled to assess the accident scale correctly, to bring out the major seats of origin of the damage and to forecast the development of radiation conditions. Thus, it was possible to organize and monitor the radiation dose of individuals promptly and on a large scale.

Coincidentally with the liquidation of the direct accident consequences, a demand arose for a radiation inspection of population, food, soil, water. This problem was promptly solved at a high level of reliability with the help of the standard solutions of radionuclides (SSR), which were used for manufacturing the standard specified measures of activity (SSMA) serving as full-scale models (simulators) of the test samples taken at the contaminated locality. Certification of the SSR was carried out with the help of the standard set-ups being a part of the state standard for the radionuclide activity. The SSMA were used to calibrate scales of the radiometers and spectrometers, as well as whole body counters at the laboratories of sanitary-epidemiology services including those situated in the regions of the radiation contamination. At the same time, to certify the radiometer set-ups and to measure the radionuclide activity in the samples, some methods and corresponding procedures were developed. Thanks to the System, they were brought up to their direct executors.

Thus, owing to the existence of the System, it was possible to solve the problem of carrying out reliable radiation measurements under the conditions of liquidation of the large-scale accident consequences. This in itself is a good evidence that the choice of a centralized system for metrological assurance within this field of measurements in Russia has been chosen correctly.

Once the System has been created, it is being continuously developed and improved. One of the most urgent problems which it faces now, is the creation of a network of laboratories for monitoring the radiation. These laboratories will be accredited for the right to carry out the radiation measurements according to the rules regulated by the ISO/IEC standards for the testing laboratories included in the system of radionuclide product certification. This will permit to harmonize the structure, rates and rules accepted for the System functioning in Russia with due regard to the corresponding elements of the testing laboratories of the other countries where the international standards are being used.