Improvement of national standard of X radiation

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At the year 1998 the *Standard of X radiation air kerma and dose equivalent and their rates* of the Slovak Institute of Metrology was approved and declared as the *national standard.*

From that time there were observed considerable progress of the measuring techniques and of the measurements, too. That reflected into the several upgradings of instrumentation of this standard and improvement of its metrological parameters.

At 2004 was performed the revision of the national standard of air kerma,and dose equivalent of the X radiation and their rates and it was renamed to *National standard of X radiation.*

There have been done the following modifications, upgradings and changings of the basic or auxiliary devices and of the measuring processes:

- substitution of electrometers made in SMU to proven Keithley remote controlled electrometers, to reduce the background and the uncertainty of the simultaneous measurements of the charge from the monitoring ionisation chamber and from the standard or tested ionisation chamber;
- replacement of the mercury temperature meters, mercury atmospheric pressure meter and nap relative atmospheric humidity meter to the remote controlled and continuously measuring electronic temperature meters, pressure meters and humidity meter to reduce the uncertainty of the estimation of the ambient conditions during the measurement of the standard or testing chamber or dosimeter;
- utilisation of the Mylar foil to blockage the X-ray beam aperture of the lead shielding of the X-ray generator to prevent the flow of the warm air from the X-ray generator direct to the transmission monitoring chamber and to reduce the variation of the ambient conditions close of the monitoring chamber;
- the thickness and orientation correction of the energy filtration segments to have better approach to the specification of the reference X-ray beams listed in the international standards to reduce the inhomogenity on the effective cross area of the reference X-ray beams and to have better approach to the first and second HVL listed in the ISO 4037-1: 1996;
- utilisation of two remote controlled temperature meters and pressure meters to measure the current values of the temperature and of the pressure separate but at the same time at the area of the X-ray beams transmission monitoring chamber and at the area of the standard or testing chamber or dosimeter to reduce the errors from the using of the same correcting factor on ambient temperature and pressure to the monitoring chamber and standard chamber, even though that the ambient temperature close of the monitoring chamber is not the same as the close of the standard chamber;
- utilisation of the adapted software to continual automatic measurements of the two remote controlled contemporary measurements of the charge integrated at the assigned time period from the monitoring ionisation chamber and from the standard ionisation chamber with the contemporary correction to the actual temperature and pressure and wit their graphical visualisation at the real time, to reduce the uncertainty of the measurements from the unsteady X-ray generation;
- utilisation of the optical prism, the laser pointers beams and two perpendicular laser plane beams to trace the reference point and the reference planes in the reference X-ray beams and to easy replace the reference or the test detectors and phantoms too and to easy measure the angular dependence of their response to reduce the uncertainty of the reference distance of the standard and tested detector and to reduce the uncertainty of the angel of the incidence settings;
- utilisation of the ISO water phantoms instead of the pure PMMA phantoms for calibration or to testing of the personal dosimeters and the dosimeters of the X-ray beams quality to reduce the uncertainty of the conversion coefficients from air kerma to personal dose equivalent.

All this modification, upgrading and changing brought the simplification and the improvement to the measurements, to the calibrations and to the tests made with utilisation of the national standard of X radiation.