VNIIM activities on Radiation Dosimetry 2003-2005

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Introduction

The main directions of activities of the IRLAB dosimetry group during this period:

- research work for improvement of the primary standard for air kerma and air kerma rate of X- and gamma-ray, of the primary standard for absorbed dose and absorbed dose rate to tissue for beta-radiation and of the primary standard for flux, flux density and fluence of electrons, flux energy, flux density energy and fluence of energy electron and bremsstrahlung radiation with energy up to 50 МэВ; transfer of the size of units to the secondary and working standards;
- the international cooperation;
- calibration and verification of measuring devices, radionuclide sources, measuring systems, apparatus and installations;
- type tests of dosimetric, radiometric and spectrometric means of measurements;
- certification of production based on use of generating and radionuclide sources for radiation safety;
- elaboration of technical documents, instruction manuals, verification methods and techniques of performance of measurements in the field of ionizing radiation dosimetry.

1 Research work

In 2004 a new x-ray apparatus ISOVOLT HS-320 was purchased and put into operation for the standard for air kerma and air kerma rate of x-ray. Now the research of radiation qualities are carring out:

- radiation qualities of series L, H, N according to ISO 4037;
- radiation qualities of BIPM - for key comparisons in the field of high-energy x-ray;
- radiation qualities of state standard GOST 8.087-2000 currently in force in Russia;
- radiation qualities of series RQR and RQA according to IEC 61267.

For the participation in the comparison of the standards for absorbed dose rate to tissue for beta-radiation under program EUROMET project No.739 the radionuclide source Pm-147 was purchased and investigated.

Researches of parameters and characteristics of the fields of electron radiation with energy up to 50 МэВ for industrial accelerators type UELP-5-1C manufactured by NIIEFA (St.Petersburg) were carried out.

2 International cooperation

VNIIM calibration services (CMC) in the field of dosimetry have passed regional and inter-regional examination, and on April 2004 they were registered and submitted on site BIPM.

Regional and inter-regional examinations of calibration services of national metrological institutes such as CRPH (Cuba), NIM (China), NIST (USA), AIST (Japan), CNEA (Argentina) were carried out by VNIIM.

The preparation for carrying out of comparison COOMET.RI-K1 within the framework of the COOMET Project 318/RU/04 of the standards for air kerma in the ^{60}Co radiation beam has been started. According to preliminary agreement PTB (Germany), BelGIM (Byelorussia), KhNIIM (Ukraine), CRPH (Cuba) and some other metrological institutes will take part in this comparison. VNIIM will do the duty of a

pilot laboratory.

The preparation to the VNIIM participation in the comparison of the standards for air kerma (^{60}Co) within the framework of the EUROMET project No.813 (BIPM KCDB: EUROMET. R (I)-K1) is conducted.

The IRLAB dosimetry group (in a rank of laboratories SSDL) is annual participant in the work under the program IAEA/WHO TLD postal dose quality audits for radiotherapy level dosimetry of a Co-60 beam and high energy x-ray beam of the linear accelerators in different Oncological Centers of Russia.

3 Calibration and verification of measuring means

For past two years the comparison of the secondary standards for air kerma and air kerma rate were carried out with the primary standard in the ^{137}Cs and ^{60}Co radiation beams. Secondary standards belong to the regional centers of metrology and standardization: the TEST (St.Petersburg), FGUP "UralTEST" (Ural ragion), Scientific Centres SNIIP (Moskow) and NIIP (the Moscow region). The comparison was undertaken using with electrometer Keithley 6517A and two ionization chambers such as M30001 and TM 32002 (UNIDOS) as transfer instruments. Total uncertainty is 0,8 - 1,0 %.

Calibrations and verifications (more than 700) of the standard and working dosimetric devices and radionuclide sources (Cs-137, Co-60, Cd-109, Fe-55, Ra-226, Sr-90/Y-90, Tl-204, Pm-147, Ni-63, H-3) including ones for the enterprises manufacturing of the radionuclide production were fulfilled.

4 Tests of means of measurements with the purpose of the confirmation of type

The tests more than 20 means of measurements of the Russian and foreign manufacturers were carried out with the purpose of type validation and entering in State Register for conformation of technical documentation requirements and the requirements of standards extending on these instruments. Among them universal dosimeters DKS-AT 5350 (NPP "ATOMTECH", Byelorussia), personal dosimeters DOSICARD, ТЛД dosimeters Harshaw 8814 and 8806 with complete of ТЛД system Harshaw 6600 (Canberra, USA), road monitors of detection of nuclear materials (TEC "RATEK").

5 Certification of the production for radiating safety

The x-ray complexes intended for the roentgenoscopic control, such as " GRIF" (“Gamma”, Moskow) and "Fosmomatic" ("Testron", St.Petersburg) were certificated on radiation safety and functional parameters.

6 Elaboration of the normative documents

When carrying of the tests ten verification methods for means of the measurements delivered on import including the dosimeters - radiometers were worked up.

Techniques of performance of the measurements for the absorbed dose to air and the ambient dose rate equivalent with application of individual dosimeters are developed. These methods are used for realization of the radiation control of X-ray rooms, protective overalls for the laboratories of Ministry of Health, objects of an environment and territories for the Sanitary Inspection services and ecological laboratories of the radiation control.

The final edition of Interstate Standard for CIS countries “Ionizing radiations and their measurements. Terms and definitions” was wrote. It standardizes the terminology including the ionizing radiation field.

The list of publications for 2003-2004
in the field of photon, electron and beta-radiation dosimetry

1 Fedina S.A., Fominykh V.I., Oborin A.V., Periodic varification by the «doze by mail» method for the individual radiation control means in the system of the Sanitary Inspection Centers, *Transactions of the international scientific - practical conference "Metromed* -2003" October, 7-9, *Measuring information technologies and devices of health protection*, СПбГУ, 2003, pp. 93-94.

2 Fominykh V.I., Kharitonov I.A., Trofimchuk S.G., Accreditation of the laboratories of radiation control, *Transactions of the international scientific - practical conference "Metromed* -2003" October, 7-9 2003 «*Measuring information technologies and devices of health protection» СПбГУ*, 2003, pp. 94-95.

3 Fominykh V.I., Kalnitsky S.A., Logovoj J.N., Zolotareva T.N., Carrying out of radiation control at use of ionizing radiation sources in medicine, *Life and Safety*, 2004, **3-4**, pp. 273-286.

4 Fominykh V.I., Kalnitsky S.A., Logovoj J.N., Zolotareva T.N., The radiation control ensuring in medicine» *ANRI,* 2004, **4** (**39**), pp. 20-27.

5 Kharitonov I.A., Oborin A.V., Villevalde N.D., The State primary standard of Russia for exposure and exposure rate (air kerma and air kerma rate) of X- and gamma-ray). Some aspects of application into medical radiation dosimetry. *Transactions of the international scientific – practical conference « Measuring information technologies and devices of health protection» "Metromed* -2003" October, 7-9 2003.

6 Kharitonov I.A., Oborin A.V., Villevalde N.D., Some aspects of application of the state primary standard of Russia for exposure and exposure rate (air kerma and air kerma rate) of X- and gamma-ray into medical radiation dosimetry, *The materials of the IV International Symposium «Actual problems of dosimetry»* Minsk, 23-24 October, 2003.

7 Helmstädter K., Böhm J., Ambrosi P., Fominych V., Rumyantseva E., Fedina S., Comparison of extrapolation chamber measurements of the absorbed dose rate for beta radiation between VNIIM (Russia) and PTB (Germany), *Metrologia*., 2004, **41**, *Tech. Suppl*., 06008

8 Lecante C., Uryaev I., Villevalde N., Rumyantseva E., Chauvenet B., Comparison of extrapolation chamber measurements of the absorbed dose rate in beta radiation, *Metrologia*., 2004, **41**, *Tech. Suppl*., 06009