

Recent Activity of VNIIM Neutron Group in 2003 – 2005

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In 2003 - 2005 the main efforts of neutron measurements group of VNIIM have been concentrated on improving of the standard equipment and techniques for neutron sources and fields parameters measurements. The basic directions of activity were:

- key comparisons (measurements according to comparisons program and preparing to planned comparisons)
- inter-regional review of CMC-tables
- testing and certification of new types of measuring system
- calibration and verification of measuring instruments for users and manufacturers
- elaboration of the normative documents.

During the preparing to comparisons according to EUROMET PROJECT #608

The $(^{252}\text{Cf}+\text{D}_2\text{O})_{\text{Cd}}$ source was developed by specialists of VNIIM according to Recommendation ISO 8529-1. The source was manufactured by Scientific Technical Centre "RADEK", St.Petersburg.

The 30 cm diameter sphere is made of aluminum 0.5 mm thick covered by a 1 mm cadmium layer and filled in by heavy water. The ^{252}Cf -source № 15-3/01 is hanged up in on a thin silk thread in an aluminum container 0.2 mm thick in the center of the sphere. The source design was developed by specialists of VNIIM according to Recommendation ISO 8529-1. The source was manufactured by Scientific Technical Centre "RADEK", St.Petersburg.

Before making the measurements the main characteristics of the devices used as a tool of comparison were determined.

The results of this investigations are following:

Only Harwell N91 is suitable to be a comparison instrument.

Sdudsvik rem-meter is not suitable to be used a comparison instrument. The main reason of that is the device reading does not return to the initial value after turning off and then turning on again. Moreover, the value and even the direction of this change depends on the value of counting rate.

However, after the consultation with the comparisons coordinator we made a decision to try to make measurements with this device too.

Draft report on this measurements was sent to comparisons coordinator.

Preparing to CCRI(III)-K8.B10 key comparison we tested different techniques of thermal neutrons fluence measuring. An installation simulated both isotropic and quasidirected field of thermal neutrons was developed. The facility comprises a polyethylene block in the form of a cube, 900 mm on edge, with a central spherical cavity 450 mm diam. covered on the outside by borated polyethylene 50 mm thickness. Four channels for placing of radionuclide neutron sources get it possible to provide thermal neutron fluence rate in the central cavity up to $10^5 \text{ s}^{-1}\text{cm}^{-2}$. Six channels provide the beam-like thermal neutron field with mean value of fluence rate about $10^3 \text{ s}^{-1}\text{cm}^{-2}$ with neutron temperature $T_n = (314 \pm 3)\text{K}$.

An appliance makes able to imitate of the detector irradiation in a field with unknown angle distribution as if it were the uniform field was developed. A special device employs rotation of the detector, in two perpendicular planes with adjusted relations of rotating rates. The detector being fixed in the holders. In this cause similar positioning is obtained at every angle.

The method described was tested by determination of the thermal neutron fluence in the field of the setup intended for the calibration of radiation safety devices. The setup contains a calibrating bench on which a thermal neutron source and a movable carriage for positioning the

devices are located. The thermal neutron source consists of a moderator for a wide neutron beam. A radionuclide neutron source is located in the center of moderator. Within the range from 0.2 to 3.0 m the angle distribution of the thermal neutrons varies from a distribution close to 2π to next to parallel beam distribution. The results obtained by using the described technique are in good agreement with $1/r^2$ -law for uniform distribution.

VNIIM calibration services (CMC) in the field of neutron measurements have passed regional and inter-regional examination, and on April 2004 they were registered and submitted on site BIPM. During last two years SMSs for APMP, COOMET, EUROMET and SIM were reviewed. Some recommendations were suggest.

One of the main directions of the laboratory activity is testing of new types of the measurements means produced by Russian and foreign enterprises. During last two years we were carrying out tests of the multi-purpose device SRK-AT1117 developed and produced by Belarusian enterprise "ATOMTECH", TLD dosimeters Harshaw 8814 and 8806 with complete of TLD system Harshaw 6600 (Canberra, USA).

A significant part of the activity executed in 2003 - 2005, is connected with our traditional duty which is the safety assurance of nuclear objects that are in operating or being built now. In particular, certification of secondary standards is executed for the following enterprises:

- secondary standard of thermal neutron field, being used for the quality control of nuclear power station safety systems at the I.V.Kurchatov Institute;
- standard complex of measurement means, being used to provide radionuclide products quality at the Atomic Reactors Institute;
- complex of measurement means used on icebreakers.

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