Secondary Standard Dosimetry Laboratory in Central Laboratory for Radiological Protection in Poland

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INTRODUCTION

Central Laboratory for Radiological Protection (CLOR) has started measurements for establishing within its department a Secondary Standard Dosimetry Laboratory (SSDL). The planned SSDL will cover wide range of dosimetry calibration standards including already accredited methods of calibration with a use of standardized field of gamma and X-ray radiation as well as alfa and beta surface contamination sources and, additionally after adjusting to SSDL's requirements, Beta Secondary Standard (BSS-2) and Neutron Calibration stand with Am-Be source.

Presented work shows a conception of the planned development and validation of existing and newly implemented methods including part of realized Monte Carlo (MC) simulations designed to adequate a relocation of the stands within laboratory to minimize their influence on the quality of calibration process.

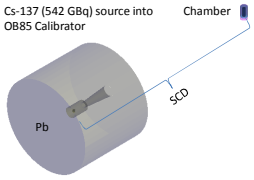
MATERIALS AND METHODS

Presented results concern to Gamma Stand equipped with OB85/3 irradiator with Cs-137 (524 GBq) source and Neutron Stand with OB26 calibrator containing Am-Be (185 GBq) source. For air kerma measurements PTW UNIDOS electrometer with PTW type 23361 chamber calibrated in Polish Primary Standard Laboratory was used. For Gamma Stand MC simulation have been made using MCNPX ver 2.7.0 code. Results of simulations were based on F4 tally (flux averaged over a cell) with fluence-to-kerma conversion coefficients from ICRU 57 [2] and ENDF/B-VI Release 8 cross-section files. For neutron calculation MCNP5 code was used. Comparison of neutron flux at point detector, tally F5, for two configurations with and without calibration table were made.

RESULTS OF MONTE CARLO SIMULATION

GAMMA CALIBRATION STAND

MCNPX



UNIDOS with PTW chamber, OB85/3

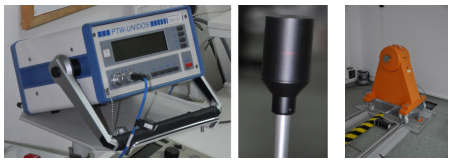


Table 1. Comparison between air kerma measured and calculated by MC simulation for Cs-137 source on Gamma Calibration Stand

SCD, cm	Absorber, mm Pb	UNIDOS, mGy/h	MCNPX, mGy/h	Difference, %
83	0	54.75	55.50	1.4
100	0	37.80	37.87	0.2
150	2.25	1.23	1.21	1.0

NEUTRON CALIBRATION STAND

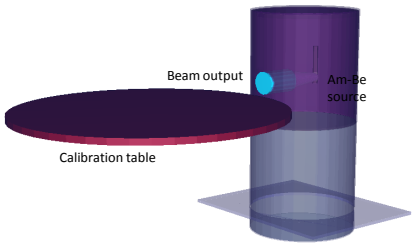


Table 2 Differences in values of H(10) between two configurations of Neutron Stand*

Distans source - detector [cm]	100	150	200	250	300	350	400
Configuration with calibration table							
H*(10) [μSv/h]	210,0	88,7	46,7	28,4	19,3	14,0	10,7
Configuration without calibration table							
H*(10) [μSv/h]	186,1	78,9	43,5	27,5	19,0	13,9	10,7
Difference, %	11,4	11,1	6,9	3,2	1,4	0,6	0,04

CONCLUSION

- CLOR's Laboratory is equipped with X-ray, gamma, beta (BSS-2) and neutron source.
- SSDL's requirements for each of the calibration standards were defined.
- Monte Carlo (MC) simulations to adequate a relocation of the stands within laboratory to minimize their influence on the quality of calibration process were designed.
- Establishing SSDL in CLOR will improve the dosimetry monitoring in the current activities and future needs regarding nuclear energy program.
- Good agreement of measured and calculated value of air kerma rate at Gamma Stand providing to small influence of hall infrastructure for calibration results – not needed additional changes at hall organization
- High influence of the neutron calibration table for the neutron fluence at measuring point – replacement of the table is taken into consideration

REFERENCES

1 SSDL Network Charter, IAEA, Viena, 1999

2 Conversion Coefficients for use in Radiological Protection Against External Radiation, ICRU Report No. 57, 1998

3 Mazrou H., Sidahmed T., Allab M., Neutron Field Characterisation Of The OB26 CRNA Irradiator In View Of Its Use For Calibration Purposes, Rad. Prot. Dosim., Vol 141, No. 2, pp. 114-126

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