

## New correction factors for the OMH air kerma standard for $^{137}\text{Cs}$ and $^{60}\text{Co}$ radiation

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In the Dosimetry Group of the Ionizing Radiation Section at the OMH, some correction factors of the primary standard of air kerma for  $^{137}\text{Cs}$  and  $^{60}\text{Co}$  gamma rays have recently been changed. These changes affect the latest BIPM-OMH key comparison (BIPM.R(I)-K1) results and hence the degree of equivalence of the OMH standard. The technical details of these changes and re-evaluated results of the comparison published in Rapport BIPM-94/13 are reported here. (*The Rapport BIPM-2000/05 (key comparison BIPM.R(I)-K3) uses the new correction factors for the air kerma standard of the OMH for medium energy X-rays.*)

The reasons for the changes to the correction factors for the cavity chamber, type ND 1005, were the availability of the new calculation code (CAVRZnrc), the published calculation results for wall attenuation and scattering of different cavity chambers (NRC Report PIRS-663), and the new calculation and experimental results of PTB-OMH joint investigation of the  $k_{\text{wall}}$  correction factor and comparison results. (These results are awaiting publication.)

The table below contains the correction factors according to the Rapport BIPM-94/13 for the graphite cavity chamber type ND 1005 which have been affected. The revised correction factors  $k_{\text{wall}}$  for the complete wall effect (attenuation and scattering) and  $k_{\text{pn}}$  the point source non-uniformity (effects of a non-parallel incident beam) were calculated using Monte carlo methods with the CAVRZnrc code (using 1 m detector distance, point source assumption and spectral incident photon beams). These calculations were also performed at the NRC in 1999 and the results for  $k_{\text{wall}}$  were slightly greater (0.07 %) for both radiations. It should be noted that the input spectra of  $^{60}\text{Co}$  and  $^{137}\text{Cs}$  incident radiation were different at the NRC from the PTB calculations. The table also shows the original and modified results of the comparison of the standards of air kerma of the OMH and the BIPM for  $^{137}\text{Cs}$  and  $^{60}\text{Co}$  gamma rays.

Correction factor	60-Co						137-Cs					
	new value	uncertainty		old value	uncertainty		new value	uncertainty		old value	uncertainty	
		s	u		s	u		s	u		s	u
$k_{\text{at}}$	1.05775			1.0157	0.05	0.05	1.08192			1.0186	0.05	0.05
$k_{\text{sc}}$	0.96548						0.95015					
$k_{\text{CEP}}$	--			0.9970		0.10	--			0.9980		0.10
$k_{\text{wall}}$ ( $k_{\text{at}} * k_{\text{CS}} * k_{\text{CEP}}$ )	1.02124	0.01	0.07	1.0127	0.05	0.11	1.02799	0.01	0.08	1.0166	0.05	0.11
$k_{\text{an}}$				0.9998		0.10				0.9998		0.10
$k_{\text{rn}}$				1.0002		0.01				1.0004		0.01
$k_{\text{pn}}$	0.9999	0.04	0.05				1.0005	0.07	0.05			
(new) $k_{\text{wall}} * k_{\text{pn}}$	1.02113	0.04	0.09				1.0285	0.07	0.10			
(old) $k_{\text{wall}} * k_{\text{cep}}$ $k_{\text{an}} * k_{\text{rn}}$				1.01265	0.05	0.15				1.01677	0.05	0.15
ratio (new/old)	<b>1.0084</b>						<b>1.0115</b>					
result $K_{\text{OMH}}/K_{\text{BIPM}}$	1.0025	(Rapport BIPM-94/13)			0.07	0.23	0.9954	(Rapport BIPM-94/13)			0.08	0.29
revised result $K_{\text{OMH}}/K_{\text{BIPM}}$	<b>1.0109</b>				0.06	0.20	<b>1.0069</b>				0.10	0.27

$k_{\text{at}}$  wall attenuation

$k_{\text{an}}$  axial non-uniformity

$k_{\text{sc}}$  wall scattering

$k_{\text{rn}}$  radial non-uniformity

$k_{\text{CEP}}$  mean origin of electron

$k_{\text{pn}}$  point source non-uniformity

**Conclusion**

**As the revised results are significantly different from the original results, it is proposed to change the air kerma standard of the OMH using the new correction factors and declare the new comparison result as shown in the table.**