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LONG-TERM QUALITY CONTROL AND INTERCOMPARISON RESULTS OF RADIONUCLIDE DOSE CALIBRATORS

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Purpose

Nuclear medicine procedure quality is critically dependent on the accuracy of dose calibrators. The aim of this study is to assess the accuracy of measurements of three dose calibrators. For a more accurate evaluation of the measuring equipment, a comparison was done between those dose calibrators and the secondary standard radionuclide calibrator traceable to National metrology institute.

Methods

The study was performed with Veenstra VDC-404, Veenstra VDC-405 and PITAGORA dose calibrators in Nuclear medicine department. These dose calibrators were compared with Capintec CRC-15R that was used as a secondary reference standard ionization chamber. This intercomparison was done with ^{99m}Tc, ^{18}F, ^{123}I and ^{137}Cs. For relative response assessment ^{137}Cs was used as a check source. Linearity checks were fulfilled with ^{99m}Tc for Veenstra VDC-405 and ^{18}F sources for PITAGORA.

Results

The results of the intercomparison show that the uncertainty for Veenstra VDC-404 and Veenstra VDC-405 was 1.5 % at a coverage factor k=2 when using ^{99m}Tc in both P6 vial and in a 1 ml syringe, while it was 3.5 % (k=2) for ^{123}I, and a linearity deviation was less than 3.1 % (k=2). The uncertainty for PITAGORA was 0.7 % (k=1) when using ^{18}F in P6 vial, for ^{137}Cs using P6 vial the geometry factor uncertainty was 0.7 % (k=1), the linearity deviation was 2.0 %. Constancy measurements accuracies were within 3 % (k=2) of the decay-corrected values for all radionuclide dose calibrators.

TRACEABILITY OF DOSE CALIBRATORS

BIPM

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National Metrology Institutes (National Physical Laboratory and Czech Metrology Institute)

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Secondary Standards Laboratory (Center for Physical Sciences and Technology, Metrology Department, Ionizing Radiation Metrology Laboratory)

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Reference Instrument (Capintec CRC-15R and Fidelis)

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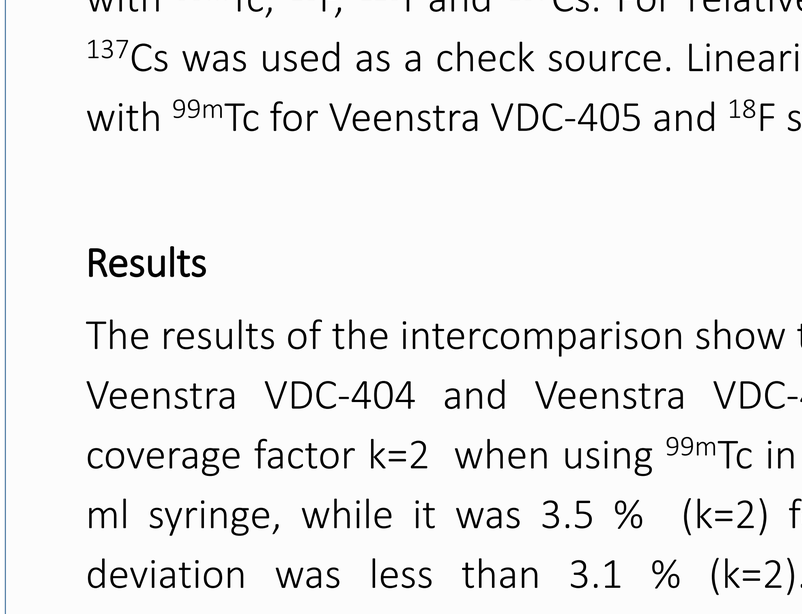
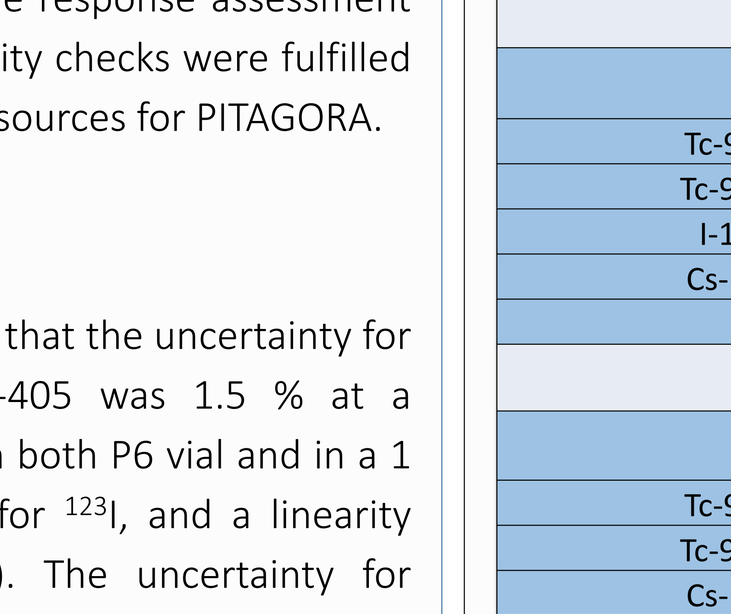
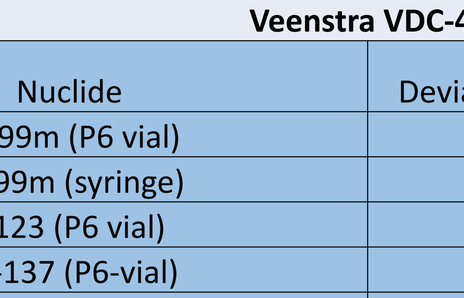
Fiels Instrument (Veenstra VDC-404, Veenstra VDC-405 and PITAGORA)

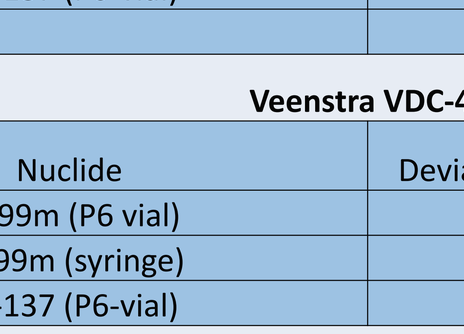
Veenstra VDC-404	
Nuclide	Deviation from reference instrument, %
Tc-99m (P6 vial)	1,5
Tc-99m (syringe)	1,2
I-123 (P6 vial)	3,5
Cs-137 (P6-vial)	0,7
Veenstra VDC-405	
Nuclide	Deviation from reference instrument, %
Tc-99m (P6 vial)	1,5
Tc-99m (syringe)	1,3
Cs-137 (P6-vial)	0,8
PITAGORA	
Nuclide	Deviation from reference instrument, %
F-18 (P6 vial)	1,3
Cs-137 (P6 vial)	0,7
Cs-137 (syringe)	0,7

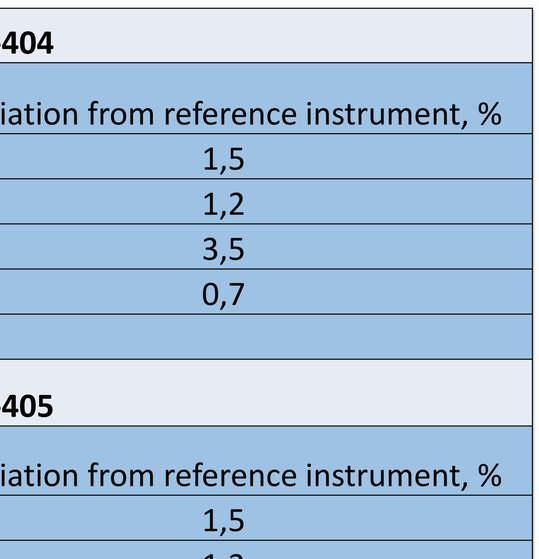
DISCREPANCIES BETWEEN REFERENCE AND FIELD INSTRUMENTS











Containers used in this intercomparison: P6 vial and 5 ml syringe.

Conclusions

Quality control and intercomparison measurements of dose calibrators are an important part of nuclear medicine quality assurance program. In accordance with international recommendations, our results are within 5-10 % of the recommended values. Daily control with a long half-life check source allows detecting potential failure of the ionization chamber components and enabling the staff to reduce the probability of an incorrect injection of radiopharmaceuticals' activity to the patients. The intercomparisons could identify problems in both calibration and uncertainty evaluation.