AUSTRALIAN AND NEW ZEALAND SOCIETY OF NUCLEAR MEDICINE INC.

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Technical Standards Sub-Committee

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TECHNICAL NOTE

Measurement of I-123 Activity in Dose Calibrators

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Extreme care is required in measuring the activity of radionuclides with a substantial proportion of low energy photon emissions. For such radionuclides, the geometry and attenuation of the source container need to be carefully considered if accurate readings are to be obtained. The manual for the dose calibrator being used will generally give the necessary measurement conditions and information necessary for the calculation of correction factors for any type of source container (syringe, vial etc).

The following caveat relates to the measurement of I-123 activity. This radionuclide is being increasingly used in nuclear medicine departments and practices throughout Australia. It is important, therefore, that nuclear medicine staff are aware of the pitfalls inherent in the measurement of its activity.

Caution is required when interpreting I-123 activity measurements from dose calibrators. The measured activity depends on the construction and geometry of the container in which the measurement is made. For the same activity, a reading for I-123 in a syringe can exceed that for a vial by up to 60%. In addition, readings are geometry dependent, so different syringes give different readings for the same activity and volume.

This problem arises because I-123 emits 27-31 keV X-Rays (as many as the 159 keV gammas) which have quite different attenuation in glass and plastic. The correction factors will also vary between dose-calibrator models, depending on the wall thickness of the ionisation chamber.

To make things worse, I-123 supplied by ARI in a vial will not read correctly (and the error will be greater than for a syringe). The radionuclide settings of most dose calibrators are factory-calibrated using a known activity of the radionuclide in a 5 mm solution in a flame-sealed glass ampoule of 0.6 mm wall thickness. The vials used by ARI have a wall thickness of 1.2 mm, and the vials used in your department will probably have a wall thickness of 1.2 mm as well. To obtain the correct activity for I-123 in a vial or syringe, a correction factor or a different dose calibrator setting must be applied. Both approaches require calibration of your dose calibrator with a known activity of I-123. You should also standardise on the syringe size for which the calibration is done. Alternatively, a modified procedure may be used as described by Kowalsky and Johnston (J Nucl Med Tech 1998; 26:94-98). In this paper a copper filter is used to attenuate the low energy x-rays, making the calibration virtually independent of the type of vial or syringe.

Avoid using your dose calibrator for I-123 until you are sure it has been properly calibrated for this purpose. As an interim measure, if you have ordered a particular activity of I-123 from ARI (or any other company) and you need to take aliquots, do so on a volumetric basis.

In the short term, an approximate calibration of your dose calibrator can be achieved with any dose of I-123 supplied by ARI (or any other company). The measured activity in the original (supplied) vial can be calibrated against its nominal activity corrected for decay. In the longer term, the Technical Standards Sub-Committee is planning a systematic calibration using I-123 standards purchased from ANSTO.