AbstractID: 10390 Title: Impact of source production revision on the photon energy spectrum and dose rate constant of Cesium-131 sources

Purpose: The Model CS-1 Cesium-131 source has been used by many radiation therapy clinics in prostate brachytherapy since its introduction in 2004. This source model has since undergone a production revision known as CS-1 Rev.2. The aim of this work was to investigate the influence of source production revision on the photon energy spectra emitted by the Cesium-131 sources and on the dose rate constant. **Method and Materials:** Three Cesium-131 Rev.2 sources were obtained from source manufacturer. The relative energy spectrum of the photons emitted by each source along the radial direction in the source's bisector was measured by a high-resolution Germanium detector designed for low-energy photon spectrometry. The dose rate constant ($_{PST}\Lambda$) of each source was determined from the measured photon energy spectrum and the activity distribution within the source. The spectra emitted by the Rev.2 sources were compared to those emitted by the original CS-1 sources. The influence of source production revision on $_{PST}\Lambda$ was examined and quantified. **Results:** The energy spectrum arising from the principal emissions of ^{131}Cs along the radial direction in the bisector was nearly identical before and after the revision. However, the fluorescent x-ray yield, due to the presence of niobium in source construction materials, was significantly lower in Rev.2 source (~35% of the Nb-K_α and Nb-K_β x-ray intensities measured in the original model). As a result, the $_{PST}\Lambda$ of Rev.2 source was increased by approximately 0.7% from 1.066 of original model to 1.073 $cGyh^{-1}U^{-1}$. **Conclusions:** Source production revision for low-energy brachytherapy sources could lead to unintended modifications of their basic dosimetry properties. While the overall dosimetric impact of the production revision Rev.2 for the Cesium-131 source was found small, this study demonstrated that photon spectrometry can be used as a sensitive and convenient tool for monitoring the dosimetric impacts of source production revision.