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Analytic solution for source distributions achieving a uniform dose WILLIAM ATKINSON, The Boeing Company — Interstitial brachytherapy involves implanting many small radioactive sources into the tumor, the goal being delivering a uniform radiation dose to the target volume. We assumed a spherical tumor irradiated by a continuous distributed radiation source. Solution of the ensuing integral equation shows that the source density is very low near the center of the sphere, increases rapidly toward the surface, and becomes infinite at the surface. Integration of the source density over a given spherical sub-volume shows that only about 6% of the total activity is contained in the core up to 50% of the tumor radius, while about one-half of the activity has to be placed in the outer spherical shell having a thickness of one-tenth of the tumor radius. This situation is approximated in the high-dose-rate (HDR) treatment of the prostate using 192Ir. The results are in good agreement with the recommendations given in the traditional Patterson-Parker tables for radium and cesium treatment.

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