

Dosimetry Data for Prospera® Pd-103 Brachytherapy Source



As recommended in the updated report² of the American Association of Physicists in Medicine Task Group number 43, treatment planning should proceed using established methods and established dosimetric parameters determined for a manufacturer's specific seed design having NIST standardization. In meeting the TG43 recommendations for the Brachytherapy Services, Inc. Prospera® Pd-103 brachytherapy source model MED3633, measurements using thermoluminescent dosimeters in a water-equivalent plastic phantom³ agree with Monte Carlo simulation calculations⁴. The TG43 updated report provides the following evaluated dosimetric data for planning therapy when using the Prospera® Pd-103 source. Supplemental dosimetric data may also be found in other compilations⁵.

Dose Rate Constant, Λ (cGy/U-hr)	0.688
Average Anisotropic Constant	0.936
Active Length (cm)	0.42

Distance (cm) r	Radial Dose Function	
	Line Source Formation $g_L(r)$	Point Source Formulation $g_p(r)$
0.25	1.331	1.123
0.30	1.322	1.170
0.40	1.286	1.201
0.50	1.243	1.194
0.75	1.125	1.113
1.00	1	1
1.50	0.770	0.776
2.00	0.583	0.589
2.50	0.438	0.443
3.00	0.325	0.329
3.50	0.241	0.244
4.00	0.177	0.179
5.00	0.098	0.099
6.00	0.053	0.054
7.00	0.028	0.028

Polar Angle θ (Degrees)	Anisotropy Function, $F(r, \theta)$ and Anisotropy Factor, $g_{an}(r)$					
	r (cm)					
	0.25	0.5	1	2	5	10
0	1.024	0.667	0.566	0.589	0.609	0.733
10	0.888	0.581	0.536	0.536	0.569	0.641
20	0.850	0.627	0.603	0.614	0.652	0.716
30	0.892	0.748	0.729	0.734	0.756	0.786
40	0.931	0.838	0.821	0.824	0.837	0.853
50	0.952	0.897	0.890	0.891	0.901	0.905
60	0.971	0.942	0.942	0.940	0.948	0.939
70	0.995	0.976	0.974	0.973	0.980	0.974
80	1.003	0.994	0.997	0.994	1.000	0.986
$g_{an}(r)$	1.257	0.962	0.903	0.895	0.898	0.917

Brachytherapy Services, Inc. Prospera® Pd-103 brachytherapy sources are calibrated under the 1999 (revised) WAFAC air-kerma strength standard¹ at the National Institute of Standards and Technology (NIST) on standard date, 23-April-2001, used by NIST and Accredited Dosimetry Calibration Laboratories (ADCL). The Prospera® Pd-103 source dose-rate constant, Λ , is stated with reference to this standard.

Per TG43² and for historical purposes, the Apparent Activity of Prospera® Pd-103 sources may be obtained by applying a conversion factor of 1.293 U/mCi.

References:

- Loevinger, R., "Wide-angle free-air chamber for calibration of low energy brachytherapy sources," Medical Physics **20**,907 (1993).
- Rivard, M.J., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Huq, M.S., Ibbott, G.S., Mitch, M.G., Nath, R., and Williams, J.F., "Update of AAPM Task Group No. 43 Report: A revised AAPM protocol for brachytherapy dose calculations," Medical Physics, **31**,633-674 (2004).
- Wallace, R.E. and Fan, J.J., "Dosimetric characterization of a new design ¹⁰³palladium brachytherapy source" Medical Physics **26**,2465-70 (1999).
- Li, Z., Palta, J.R., and Fan, J.J., "Monte Carlo calculations and experimental measurements of dosimetry parameters of new ¹⁰³Pd source," Medical Physics **27**,1108-1112 (2000).
- Taylor, R.E.P. and Rogers, D.W.O., "More accurate fitting of ¹²⁵I and ¹⁰³Pd radial dose functions," Medical Physics **35**, 4242-4250 (2008).
[Line source, Radial dose function calculator: http://www.physics.carleton.ca/clrp/seed_database/]

Dosimetry Data for Prospera® I-125 Brachytherapy Source



As recommended in the updated report² of the American Association of Physicists in Medicine Task Group number 43, treatment planning should proceed using established methods and established dosimetric parameters determined for a manufacturer's specific seed design having NIST standardization. In meeting the TG43 recommendations for the Brachytherapy Services, Inc. Prospera® I-125 brachytherapy source model MED3631-A/M, measurements using thermoluminescent dosimeters in a water-equivalent plastic phantom^{3,4} agree with Monte Carlo simulation calculations^{4,5}. The TG43 updated report provides the following evaluated dosimetric data for planning therapy when using the Prospera® I-125 source. Supplemental dosimetric data may also be found in other compilations⁶.

Dose Rate Constant, Λ (cGy/U-hr)	1.036
Average Anisotropic Constant	0.950
Active Length (cm)	0.42

Distance (cm) r	Radial Dose Function	
	Line Source Formation $g_L(r)$	Point Source Formulation $g_p(r)$
0.25	0.998	0.842
0.50	1.025	0.985
0.75	1.019	1.008
1.00	1	1
1.50	0.954	0.962
2.00	0.836	0.845
3.00	0.676	0.685
4.00	0.523	0.530
5.00	0.395	0.401
6.00	0.293	0.297
7.00	0.211	0.214

Polar Angle θ (Degrees)	Anisotropy Function, $F(r,\theta)$ and Anisotropy Factor, $\sigma_{an}(r)$					
	r (cm)					
	0.25	0.5	1	2	5	10
0	1.038	0.690	0.702	0.667	0.718	0.771
10	0.984	0.700	0.662	0.676	0.728	0.758
20	0.916	0.761	0.747	0.764	0.794	0.815
30	0.928	0.854	0.846	0.852	0.871	0.878
40	0.941	0.909	0.906	0.909	0.918	0.914
50	0.962	0.949	0.949	0.950	0.958	0.954
60	0.975	0.975	0.975	0.975	0.983	0.972
70	0.991	0.989	0.992	0.990	0.993	0.989
80	0.999	0.999	1.003	0.996	0.998	0.999
$\sigma_{an}(r)$	1.288	1.008	0.952	0.945	0.948	0.948

Brachytherapy Services, Inc. Prospera® I-125 brachytherapy sources are calibrated under the 1999 (revised) WAFAC air-kerma strength standard¹ at the National Institute of Standards and Technology (NIST) on standard date, 30-June-2001, used by NIST and Accredited Dosimetry Calibration Laboratories (ADCL). The Prospera® I-125 source dose-rate constant, Λ , is stated with reference to this standard.

Per TG43² and for historical purposes, the Apparent Activity of Prospera® I-125 sources may be obtained by applying a conversion factor of 1.270 U/mCi.

References:

- Loevinger, R., "Wide-angle free-air chamber for calibration of low energy brachytherapy sources," Medical Physics **20**, 907 (1993).
- Rivard, M.J., Coursey, B.M., DeWerd, L.A., Hanson, W.F., Huq, M.S., Ibbott, G.S., Mitch, M.G., Nath, R., and Williams, J.F., "Update of AAPM Task Group No. 43 Report: A revised AAPM protocol for brachytherapy dose calculations," Medical Physics, **31**,633-674 (2004).
- Wallace, R.E. and Fan, J.J., "Report on the dosimetry of a new design ¹²⁵Iodine brachytherapy source" Medical Physics **26**, 1925-1931 (1999).
- Li, Z., Fan, J.J., and Palta, J.R., "Experimental measures of dosimetric parameters on the transverse axis of a new ¹²⁵I source," Medical Physics **27**, 1275-1280 (2000).
- Rivard, M.R., "Monte Carlo calculations of AAPM Task Group Report No. 43 dosimetry parameters for MED3631-A/M ¹²⁵I source," Medical Physics **28**, 629-637 (2001).
- Taylor, R.E.P. and Rogers, D.W.O., "More accurate fitting of ¹²⁵I and ¹⁰³Pd radial dose functions," Medical Physics **35**, 4242-4250 (2008).
Line source. Radial dose function calculator: http://www.physics.carleton.ca/clrp/seed_database/

