

**Note: OQ repetition on gamma cells 1 and 3:
Measurement of dose rates and transient doses, February 2013**

According to HDRL-I-01, dose rates at the reference positions have been measured and transient doses have been determined for both gamma cells 1 and 3, using transfer dosimeters from NPL.

Type of dosimeter: Alanine 3 mm pellets, 4 pellets per dosimeter

Batch: 69

Serial nos: 861 to 874

Issue date: 20 December 2012

Measurement date: 20 February 2013

NPL Certificate reference: 2012120260/1

Measurement of dose rates

For each gamma cell 5 dosimeters have been irradiated individually.

3 different dose points have been used.

Holder ID, irradiation temperature, timer setting and position (only gamma 1) have been recorded.

Irradiations:

Gamma 1

Nominal dose [Gy]	Dosimeter	Holder	Irr. Date	Irr. Temp. [°C]	Timer [m]	Position [mm]
350.6	69/861	A3-1	2013-02-13	24.9	48.91	1
350.6	69/862	A1	2013-02-13	25.0	48.91	0
525.9	69/863	A3-2	2013-02-13	25.1	73.39	0
701.3	69/864	A1	2013-02-14	25.1	97.91	1
701.3	69/865	A3-1	2013-02-14	25.0	97.91	1

Gamma 3

Nominal dose [Gy]	Dosimeter	Holder	Irr. Date	Irr. Temp. [°C]	Timer [s]
350.7	69/866	A	2013-02-13	25.0	334.1
350.7	69/867	B	2013-02-13	25.0	334.1
525.9	69/868	C	2013-02-13	24.9	503.6
701.2	69/869	A	2013-02-13	25.1	673.2
701.2	69/870	B	2013-02-13	24.8	673.2

Results:

Gamma 1

Dosimeter	Irr. Date	Timer [m]	Measured dose [Gy]	Dose rate [Gy/m]
69/861	2013-02-13	48.91	349	7.13
69/862	2013-02-13	48.91	349	7.13
69/863	2013-02-13	73.39	523	7.12
69/864	2013-02-14	97.91	698	7.13
69/865	2013-02-14	97.91	697	7.11
Average				7.12

Gamma 3

Dosimeter	Irr. Date	Timer [s]	Measured dose [Gy]	Dose rate [Gy/m]
69/866	2013-02-13	334.1	353	62.4
69/867	2013-02-13	334.1	352	62.3
69/868	2013-02-13	503.6	530	62.5
69/869	2013-02-13	673.2	703	62.2
69/870	2013-02-13	673.2	706	62.5
Average				62.4

Measurement of transient doses

For each gamma cell, two dosimeters have been irradiated to the same irradiation time – but one continuously and one fractionated. The nominal doses have been chosen for gamma 1 and 3, respectively, so that the transient time makes up a considerable portion of the fractionated irradiation times.

Irradiations:

Gamma 1

Nominal dose [Gy]	Dosimeter	Holder	Irr. Date	Irr. Temp. [°C]	Timer [m]	Position [mm]
17.6	69/871	A3-2	2013-02-14	25.0	2.4	0
22.9	69/872	A1	2013-02-14	25.1	15 x 0,16m	-

Gamma 3

Nominal dose [Gy]	Dosimeter	Holder	Irr. Date	Irr. Temp. [°C]	Timer [s]
150	69/873	C	2013-02-13	24.9	140
226	69/874	A	2013-02-13	24.9	14 x 10s

Results:

Gamma 1

Dosimeter	Irr. Date	Timer [m]	Measured dose [Gy]	Transit time [m]	Transient dose [Gy]
69/871	2013-02-14	2.4	17.31	0.0536	0.38
69/872	2013-02-14	15 x 0,16m	22.6		

Gamma 3

Dosimeter	Irr. Date	Timer [m]	Measured dose [Gy]	Transit time [m]	Transient dose [Gy]
69/873	2013-02-13	140	150.3	0.0889	5.54
69/874	2013-02-13	14 x 10s	222		

E-value

E-values (see HDRL-I-31) are calculated to evaluate the deviations between the nominal and measured doses.

Uncertainty associated with NPL transfer dosimeter readings:

$$U(\text{NPL}) = 2.6\% (k=2)$$

Uncertainty associated with irradiation of dosimeters at gamma cells 1 and 3:

$$U(\text{HDRL}) = 1.06\% (k=2).$$

Dosimeter	Nominal dose [Gy]	Measured dose [Gy]	U (HDRL) [Gy]	U (NPL) [Gy]	E-value
69/861	350.63	349	3.72	9.07	0.17
69/862	350.63	349	3.72	9.07	0.17
69/863	525.93	523	5.57	13.60	0.20
69/864	701.26	698	7.43	18.15	0.17
69/865	701.26	697	7.43	18.12	0.22
69/871	17.56	17.31	0.19	0.45	0.52
69/872	22.93	22.6	0.24	0.59	0.52
69/866	350.66	353	3.72	9.18	0.24
69/867	350.66	352	3.72	9.15	0.14
69/868	525.88	530	5.57	13.78	0.28
69/869	701.20	703	7.43	18.28	0.09
69/870	701.20	706	7.43	18.36	0.24
69/873	150.01	150.3	1.59	3.91	0.07
69/874	226.03	222	2.40	5.77	0.64

All E-values are less than 1 and the results of the OQ repetition are therefore acceptable.

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