

Web appendix: Supplementary analyses

Table A1. Alternative lag assumptions. Estimates of excess relative rate (ERR) per Gy for death due to cancer, cancer other than leukemia, solid cancer and solid cancer other than lung in INWORKS.

	ERR per Gy (90% CI)	LRT	p^\dagger
5 year lag			
All cancer	0.41 (0.15 to 0.69)	6.84	0.009
All cancer other than leukemia	0.39 (0.12 to 0.67)	6.01	0.014
Solid cancer	0.37 (0.10 to 0.67)	5.29	0.022
Solid cancer other than lung	0.38 (0.05 to 0.74)	3.64	0.056
10 year lag			
All cancer	0.51 (0.23 to 0.82)	9.34	0.002
All cancer other than leukemia	0.48 (0.20 to 0.79)	8.18	0.004
Solid cancer	0.47 (0.18 to 0.79)	7.27	0.007
Solid cancer other than lung	0.46 (0.11 to 0.85)	4.73	0.030
15 year lag			
All cancer	0.58 (0.27 to 0.92)	10.18	0.001
All cancer other than leukemia	0.54 (0.23 to 0.88)	8.67	0.003
Solid cancer	0.53 (0.20 to 0.87)	7.64	0.006
Solid cancer other than lung	0.55 (0.15 to 0.97)	5.50	0.019

CI: confidence interval. LRT: likelihood ratio test statistic, 1 degree of freedom.

† Statistical significance of a test of the null hypothesis that the ERR per Gy equals zero; based on the LRT statistic interpreted as following a chi-square distribution with 1 degree of freedom.

Table A2. Mean cumulative dose, person-years at risk, observed deaths due to all cancer other than leukemia, estimated number of excess deaths due to all cancer other than leukemia, by categories of cumulative colon dose, lagged 10 years.

Cumulative dose (in mGy)	Mean dose	Person-years (thousands)	Observed	Fitted Excess ^a
< 5	0.6	6,089	10,433	5.4
5-<10	7.2	595	2,065	7.1
10-<20	14.3	545	2,026	14.3
20-<50	31.7	533	2,126	32.2
50-<100	70.1	257	1,167	37.9
100-<150	121.7	95	489	27.0
150-<200	172.1	46	306	20.3
200-<300	240.6	39	241	29.2
300-<400	341.4	14	122	16.9
400-<500	442.3	5	49	9.1
500-	630.8	4	40	9.8
Total	--	8,222	19,064	209.2

^a The excess number is calculated as the difference between the total number of deaths expected under the fitted model in a stratum and the background number of deaths obtained by multiplying stratum-specific person-time by the stratum-specific estimated baseline rate.

Table A3. Analysis using recorded external doses^a rather than adjusted estimates of colon dose. Estimates of excess relative rate (ERR) per Sv for death due to cancer, cancer other than leukemia, solid cancer and solid cancer other than lung in INWORKS.

	ERR per Sv (90% CI)	LRT [†]	<i>p</i>
Recorded photon dose, 10 year lag			
All cancer	0.37 (0.16 to 0.59)	9.19	0.002
All cancer other than leukemia	0.35 (0.14 to 0.57)	7.89	0.005
Solid cancer	0.33 (0.12 to 0.56)	6.72	0.010
Solid cancer other than lung	0.32 (0.07 to 0.60)	4.45	0.035

^a recorded in a unit of measure for equivalent dose (that is, rem or Sv)

[†] Likelihood ratio test statistic, 1 degree of freedom.

Table A4. Estimates of excess relative rate (ERR) per Gy for four categories of death due to cancer using alternative set of adjustment variables in INWORKS. 10 year lag assumption.

	ERR per Gy (90% CI)
All cancer [†]	0.51 (0.23 to 0.82)
All cancer ^{††}	0.46 (0.23 to 0.69)
All cancer other than leukemia [†]	0.48 (0.20 to 0.79)
All cancer other than leukemia ^{††}	0.41 (0.18 to 0.64)
Solid cancer [†]	0.47 (0.18 to 0.79)
Solid cancer ^{††}	0.37 (0.14 to 0.62)
Solid cancer other than lung [†]	0.46 (0.11 to 0.85)
Solid cancer other than lung ^{††}	0.35 (0.07 to 0.65)

[†]strata: country, age, sex, birth cohort, socioeconomic status, duration employed, neutron monitoring status.

^{††}strata: country, age, sex, birth cohort

CI: confidence interval

TABLE A5. Estimates of excess relative rate (ERR) per Gy for death due to cancer other than leukemia within strata of neutron monitoring status, and summary estimates of association obtained upon excluding adjustment for this variable. 10 year lag assumption.

	deaths	ERR per Gy (90% CI)
Neutron monitoring status [†]		
Flag 1	16,651	0.55 (0.17 to 0.95)
Flag 2	1,570	0.36 (-0.08 to 0.88)
Flag 3	843	0.62 (-0.50 to 2.09)
Crude estimate [‡]	--	0.20 (-0.03 to 0.45)
Adjusted estimate	--	0.48 (0.20 to 0.79)

[†]Workers were grouped into three categories. Flag 1: No positive recorded neutron dose. Flag 2: Positive recorded neutron dose not exceeding 10% of the total equivalent dose for external radiation. Flag 3: Recorded neutron dose exceeding 10% of the total equivalent dose for external radiation.

[‡]Estimate obtained upon excluding adjustment for neutron monitoring flag (but adjusted for all other covariates).

Figure S1. Relative rate of all cancer other than leukemia by categories of cumulative colon dose less than 100 mGy, lagged 10 years in INWORKS. Grey lines indicate 90% confidence intervals. The dashed line represents the fitted model for the ERR per Gy estimated over the entire cumulative dose range.

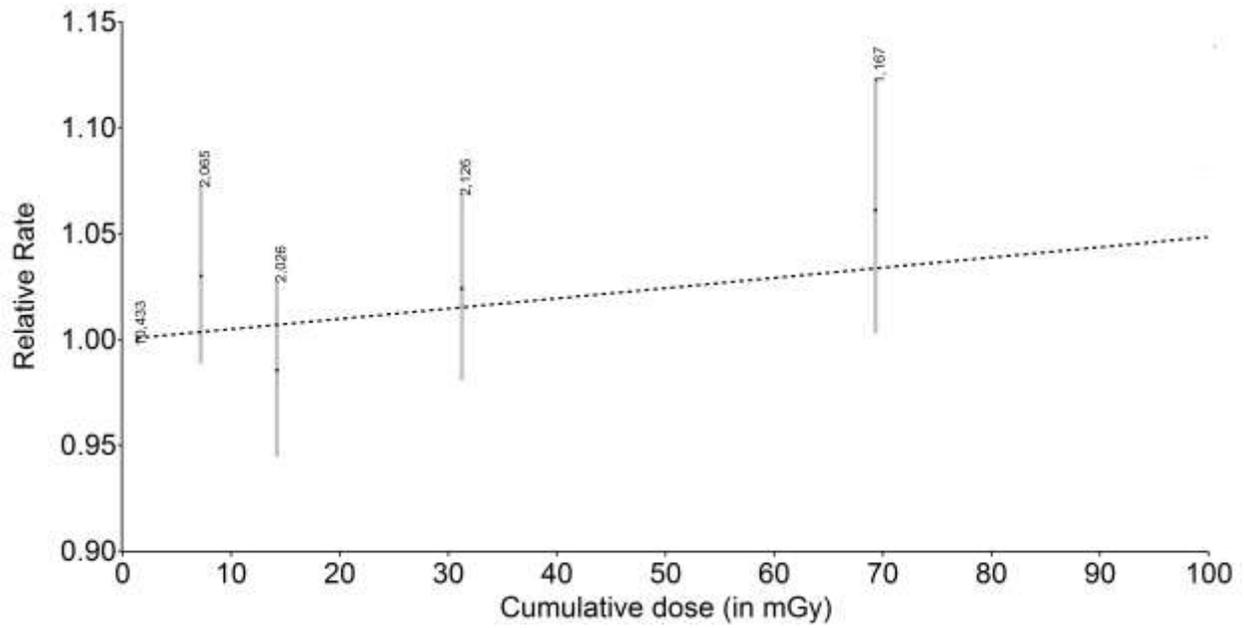


Figure S2. Estimated excess relative rate per Gy of all cancer other than leukemia by country and in the combined INWORKS data, lagged 10 years. Lines indicate 90% confidence intervals

