Supplementary tables for on-line presentation.

Supplementary Table S1. Ninety-five percent uncertainty range of the cohort distribution of thyroid doses obtained from 5,000 vectors of 2376 simulated individual doses[a]

	External Thyroid Dose (Gy)									
	Overall cohort (n=2376)		Male (n= 973)		Female (n=1403)		Kazakh (n=1549)		Russian (n=827)	
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.5E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Median (Gy)	2.1E-02	3.7E-02	2.2E-02	3.9E-02	2.1E-02	3.6E-02	3.0E-02	5.3E-02	1.2E-02	2.6E-02
Mean (Gy)	4.4E-02	7.1E-02	4.4E-02	7.2E-02	4.4E-02	7.0E-02	4.6E-02	8.0E-02	4.2E-02	6.6E-02
Maximum (Gy)	4.4E-01	1.3E+00	3.7E-01	1.2E+00	3.9E-01	1.2E+00	3.6E-01	1.1E+00	4.1E-01	1.2E+00
Variance (Gy^2)	3.2E-03	1.0E-02	3.1E-03	1.0E-02	3.2E-03	1.0E-02	2.4E-03	8.3E-03	3.2E-03	1.1E-02
	Internal Thyroid Radiation Dose (Gy)									
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Median (Gy)	1.8E-02	9.0E-02	1.7E-02	8.6E-02	1.8E-02	9.2E-02	2.6E-02	1.5E-01	1.5E-02	7.8E-02
Mean (Gy)	6.4E-02	2.2E+00	6.4E-02	2.2E+00	6.4E-02	2.2E+00	8.1E-02	3.3E+00	5.7E-02	1.8E+00
Maximum (Gy)	1.7E+00	1.5E+02	1.4E+00	1.2E+02	1.5E+00	1.3E+02	1.7E+00	1.5E+02	1.5E+00	1.3E+02
Variance (Gy^2)	1.5E-02	8.1E+01	1.5E-02	7.7E+01	1.4E-02	8.3E+01	1.9E-02	1.2E+02	1.2E-02	6.8E+01
	Total Thyroid Radiation Dose (Gy)									
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	6.4E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Median (Gy)	7.0E-02	1.6E-01	7.0E-02	1.6E-01	7.0E-02	1.7E-01	9.5E-02	2.3E-01	4.9E-02	1.4E-01
Mean (Gy)	1.2E-01	2.2E+00	1.2E-01	2.2E+00	1.2E-01	2.3E+00	1.4E-01	3.3E+00	1.1E-01	1.9E+00
Maximum (Gy)	1.9E+00	1.5E+02	1.6E+00	1.2E+02	1.6E+00	1.3E+02	1.9E+00	1.5E+02	1.6E+00	1.3E+02
Variance (Gy^2)	2.5E-02	8.1E+01	2.6E-02	7.7E+01	2.4E-02	8.3E+01	2.7E-02	1.2E+02	2.3E-02	6.8E+01

[a] Each of 5000 vectors of 2376 simulated individual doses were obtained from 1× sampling of unshared parameters in the inner loop of the 2DMC dose reconstruction model and 1× sampling of a set of outer loop parameter values that are shared by members of cohort subgroups. This process was repeated, until 5000 vectors of simulated individual doses were produced.

Supplementary Table S2. Ninety-five percent uncertainty range of the cohort distribution of thyroid doses obtained from 5,000 vectors of 2376 conditional individual mean doses[a]

	External Thyroid Dose (Gy)									
	Overall cohort (n=2376)		Male (n= 973)		Female (n=1403)		Kazakh (n=1549)		Russian (n=827)	
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	4.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Median (Gy)	2.3E-02	4.6E-02	2.6E-02	4.8E-02	2.3E-02	4.6E-02	3.0E-02	5.6E-02	1.1E-02	2.6E-02
Mean (Gy)	4.4E-02	7.1E-02	4.4E-02	7.2E-02	4.4E-02	7.0E-02	4.6E-02	8.0E-02	4.2E-02	6.6E-02
Maximum (Gy)	3.3E-01	8.6E-01	3.2E-01	8.5E-01	3.2E-01	8.1E-01	3.1E-01	8.5E-01	3.2E-01	8.1E-01
Variance (Gy^2)	2.6E-03	8.3E-03	2.7E-03	8.3E-03	2.6E-03	8.3E-03	2.0E-03	6.7E-03	2.7E-03	8.7E-03
	Internal Thyroid Radiation Dose (Gy)									
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.6E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
Median (Gy)	2.4E-02	1.5E-01	2.3E-02	1.5E-01	2.5E-02	1.5E-01	3.0E-02	2.5E-01	2.2E-02	1.2E-01
Mean (Gy)	6.7E-02	2.2E+00	6.7E-02	2.1E+00	6.6E-02	2.3E+00	8.4E-02	3.3E+00	5.9E-02	1.9E+00
Maximum (Gy)	6.3E-01	4.5E+01	5.8E-01	3.5E+01	6.0E-01	4.4E+01	6.2E-01	4.5E+01	6.0E-01	4.4E+01
Variance (Gy^2)	7.0E-03	3.4E+01	7.4E-03	3.0E+01	6.9E-03	3.6E+01	7.9E-03	4.8E+01	6.3E-03	3.0E+01
	Total Thyroid Radiation Dose (Gy)									
Cohort dose	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%	2.50%	97.50%
Minimum (Gy)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.0E-05	0.0E+00	9.0E-05	0.0E+00	0.0E+00
Median (Gy)	8.3E-02	2.4E-01	8.3E-02	2.4E-01	8.3E-02	2.4E-01	8.3E-02	2.4E-01	5.3E-02	2.0E-01
Mean (Gy)	1.2E-01	2.3E+00	1.2E-01	2.2E+00	1.2E-01	2.3E+00	1.2E-01	2.3E+00	1.1E-01	1.9E+00
Maximum (Gy)	8.8E-01	4.5E+01	8.4E-01	3.5E+01	8.4E-01	4.4E+01	8.4E-01	4.4E+01	8.4E-01	4.4E+01
Variance (Gy^2)	1.6E-02	3.3E+01	1.7E-02	3.0E+01	1.5E-02	3.6E+01	1.5E-02	3.6E+01	1.5E-02	3.0E+01

[a] Each of 5000 vectors of 2376 conditional individual mean doses were obtained from 100× resampling of unshared parameters in the inner loop of the 2DMC dose reconstruction model to produce 100 random individual dose estimates per subject, each "conditioned" on a unique fixed set of outer loop parameter values that are shared by cohort subgroups. The set of shared outer loop parameter values was resampled 1× for each successive dose vector and the 100× inner loop resampling was repeated, until 5000 vectors of conditional individual mean doses were produced.

Supplementary Table S3. Summary of Final Dose–Response Analyses for Nodule Prevalence, by Sex and Mode of Exposure

	Dose-Response Evaluated Using:								
	Conventional Regression (EPICURE)			Bayesian Model Averaging					
	"Best Estimate" Doses (from Land et al. 2008)			Simulated Individual Doses [a] (from this paper)			Conditional Individual Mean Doses [b] (from this paper)		
Cohort size	N=2994			N=2376			N=2376		
		95% CI			95% CI			95% CI	
Model description	Est.	Lower	Upper	Est.	Lower	Upper	Est.	Lower	Upper
Model 1 (Sex)									
Baseline odds parameters [c]									
$\mathrm{Exp}(\alpha_{11})$: Male subset 1, 3 [d]	0.16	0.12	0.20	0.12	0.08	0.17	0.11	0.07	0.15
$\mathrm{Exp}(\alpha_{12})$: Male subset 2 [d]	5.3E-03	8E-04	0.02	3.2E-03	5E-05	0.01	2.7E-03	6E-05	0.01
$\mathrm{Exp}(\alpha_{21})$: Female subset 1, 3 [d]	0.71	0.63	0.80	0.75	0.65	0.86	0.74	0.63	0.85
$\mathrm{Exp}(\alpha_{22})$: Female subset 2 [d]	0.13	0.08	0.19	0.12	0.07	0.17	0.11	0.06	0.17
α_3: Log ⬚ (Age screened ÷56) [e]	2.45	1.70	3.22	2.38	1.55	3.23	2.47	1.62	3.33
Dose-response (ERR/Gy)									
β_1: Total dose (males)	2.42	1.31	4.16	7.75	1.61	15.20	8.95	2.15	16.95
β_2: Total dose (females)	0.22	0.02	0.52	0.32	5E-07	0.95	0.38	7.1E-06	1.00
Model 2 (External vs. Internal Dose)									
Baseline odds parameters [c]									
$\mathrm{Exp}(\alpha_{11})$: Male subset 1, 3 [d]	0.15	0.12	0.19	0.11	0.07	0.16	0.10	0.05	0.15
$\mathrm{Exp}(\alpha_{12})$: Male subset 2 [d]	0.01	9E-04	0.02	2.7E-03	2E-06	0.01	2.4E-03	3.5E-05	0.01
$\mathrm{Exp}(\alpha_{21})$: Female subset 1, 3 [d]	0.70	0.62	0.80	0.75	0.65	0.86	0.74	0.63	0.85
$\mathrm{Exp}(\alpha_{22})$: Female subset 2 [d]	0.12	0.08	0.18	0.12	0.07	0.17	0.12	0.06	0.17
α_3: Log ⬚ (Age screened ÷56) [e]	2.33	1.56	3.10	2.41	1.16	3.29	2.51	1.65	3.39
Dose-response (ERR/Gy)									
β_3: External	2.26	0.36	5.37	1.57	5.8E-06	3.88	1.61	6.9E-05	3.83
β_4: Internal	0.60	0.18	1.11	1.61	0.04	4.36	2.64	0.07	6.78
Dose-response modifiers									
$\mathrm{Exp}(\gamma_1)$: Sex [e]	0.31	0.097	0.53	0.17	0.03	0.32	0.18	0.04	0.32

Footnotes to Supplementary Table S3

[a] 5000 vectors of 2376 simulated individual doses with shared outer loop parameter values and unshared inner loop parameter values sampled 1× per person per dose vector

[b] Each of 5000 vectors of 2376 conditional individual mean and conditional individual median doses were obtained from 100× resampling of unshared parameters in the inner loop of the 2DMC dose reconstruction model to produce 100 random individual dose estimates per subject, each "conditioned" on a unique fixed set of outer loop parameter values that are shared by cohort subgroups. The set of shared outer loop parameter values was resampled 1× for each successive dose vector and the 100× inner loop resampling was repeated, until 5000 vectors of conditional individual mean and conditional individual median doses were produced.

[c] Odds = baseline × (1 + dose response × dose-response modifiers) = $\exp\{\sum \alpha_i X_i\} \times (1 + \sum \beta_j Y_j \times \exp\{\sum \gamma_k Z_k$

[d] Subset 1 includes 1602 IRME roster subjects screened in the villages of Bolshaya Vladimirovka, Dolon, Kanonerka, Karaul, Kaynar, Korostely and Sarzhal; Subset 2 includes 303 non-roster subjects from the same villages: Subset 3 includes 471 non-roster subjects screened in the village of Novopokrovka. (See description of "Study "Population" in the Methods section of the text).

[e] "Sex" = -1 and +1 for males and females, respectively; thus dose-response coefficients correspond to a population evenly divided by sex.