

# Magnetic fields and leukaemia risks in UK electricity supply workers

Sorahan, Thomas

DOI:

[10.1093/occmed/kqu002](https://doi.org/10.1093/occmed/kqu002)

License:

Other (please specify with Rights Statement)

*Document Version*

Early version, also known as pre-print

*Citation for published version (Harvard):*

Sorahan, T 2014, 'Magnetic fields and leukaemia risks in UK electricity supply workers', *Occupational Medicine*, vol. 64, no. 3, pp. 150-156. <https://doi.org/10.1093/occmed/kqu002>

[Link to publication on Research at Birmingham portal](#)

**Publisher Rights Statement:**

This article has been accepted for publication in *Occupational Medicine*. Published by Oxford University Press.

**General rights**

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

**Take down policy**

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.



Table S1. Relative risks of leukaemia<sup>a</sup> by levels of estimated cumulative magnetic field exposure (four separate analyses), UK electricity generation workers first employed in power stations, 1973-2010.

Exposure to magnetic fields ( $\mu\text{T.y}$ ) <sup>b</sup>	n	RR <sup>c</sup>	(95 % CI)	RR <sup>d</sup>	(95% CI)
<i>Model 1. Occupational cumulative lifetime exposure to magnetic field.</i>					
0-	101	1.0		1.0	
2.5-	34	0.92	(0.62 to 1.36)	0.94	(0.64 to 1.40)
5.0-	57	0.96	(0.69 to 1.34)	0.98	(0.70 to 1.36)
10.0-	46	0.95	(0.67 to 1.35)	0.97	(0.68 to 1.39)
$\geq 20.0$	18	0.86	(0.52 to 1.42)	0.86	(0.52 to 1.43)
RR per 10 $\mu\text{T.y}$ <sup>e</sup>		0.96	(0.85 to 1.10)	0.97	(0.85 to 1.10)
<i>Model 2. Occupational exposure to magnetic fields received more than ten years ago (lagged exposure)</i>					
0-	109	1.0		1.0	
2.5-	39	1.11	(0.76 to 1.60)	1.10	(0.76 to 1.60)
5.0-	53	1.02	(0.73 to 1.43)	1.00	(0.71 to 1.42)
10.0-	42	1.07	(0.74 to 1.56)	1.06	(0.72 to 1.56)
$\geq 20.0$	13	0.81	(0.45 to 1.46)	0.79	(0.43 to 1.46)
RR per 10 $\mu\text{T.y}$ <sup>f</sup>		0.95	(0.82 to 1.10)	0.94	(0.81 to 1.08)
<i>Occupational exposure to magnetic fields received less than ten years ago (lagged exposure)</i>					
Zero	154	1.0		1.0	
0.01-	53	0.94	(0.68 to 1.30)	0.95	(0.67 to 1.34)
0.5-	17	0.68	(0.41 to 1.15)	0.69	(0.38 to 1.23)
2.0-	16	0.78	(0.45 to 1.34)	0.83	(0.45 to 1.54)
$\geq 5.0$	16	1.03	(0.59 to 1.78)	1.11	(0.59 to 2.07)
RR per 10 $\mu\text{T.y}$ <sup>g</sup>		1.04	(0.66 to 1.64)	1.20	(0.74 to 1.94)

- cancer registration or any part of death certificate coded to ICD-9 204-208.
- one year refers to a working year, approx. 250 8-hour shifts.
- analysed simultaneously with sex and attained age (5 year age groups)
- analysed simultaneously with sex, attained age, calendar period (5 year periods), and negotiating body (NJM, NJB, NJC, NJIC + NJ(B+C)E).
- five exposure categories scored by the mean value in each category, namely 0.76, 3.72, 7.27, 13.92, 38.50  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely 0.71, 3.70, 7.25, 13.75, 37.82  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely zero, 0.19, 1.11, 3.29, 12.26  $\mu\text{T.y}$ .

Table S2. Relative risks of chronic myeloid leukaemia (CML)<sup>a</sup> by levels of estimated cumulative magnetic field exposure (four separate analyses), UK electricity generation workers first employed in power stations, 1973-2010.

Exposure to magnetic fields ( $\mu\text{T.y}$ ) <sup>b</sup>	n	RR <sup>c</sup>	(95 % CI)	RR <sup>d</sup>	(95% CI)
<i>Model 1. Occupational cumulative lifetime exposure to magnetic field.</i>					
0-	9	1.0		1.0	
2.5-	6	1.73	(0.62 to 4.86)	1.69	(0.60 to 4.75)
5.0-	10	1.77	(0.72 to 4.36)	1.71	(0.69 to 4.26)
10.0-	5	1.08	(0.36 to 3.23)	1.05	(0.35 to 3.18)
$\geq 20.0$	2	0.97	(0.21 to 4.51)	1.04	(0.22 to 4.88)
RR per 10 $\mu\text{T.y}$ <sup>e</sup>		0.95	(0.67 to 1.36)	0.97	(0.67 to 1.39)
<i>Model 2. Occupational exposure to magnetic fields received more than ten years ago (lagged exposure)</i>					
0-	10	1.0		1.0	
2.5-	8	2.31	(0.90 to 5.94)	2.54	(0.97 to 6.63)
5.0-	8	1.54	(0.59 to 4.01)	1.85	(0.69 to 4.98)
10.0-	5	1.29	(0.42 to 3.93)	1.72	(0.54 to 5.45)
$\geq 20.0$	1	0.62	(0.08 to 4.99)	0.97	(0.11 to 8.15)
RR per 10 $\mu\text{T.y}$ <sup>f</sup>		0.89	(0.58 to 1.35)	0.94	(0.61 to 1.46)
<i>Occupational exposure to magnetic fields received less than ten years ago (lugged exposure)</i>					
Zero	16	1.0		1.0	
0.01-	6	0.94	(0.36 to 2.45)	0.59	(0.21 to 1.66)
0.5-	5	1.58	(0.55 to 4.50)	0.64	(0.18 to 2.29)
2.0-	2	1.74	(0.16 to 3.41)	0.31	(0.06 to 1.73)
$\geq 5.0$	3	1.58	(0.41 to 6.00)	0.68	(0.14 to 3.24)
RR per 10 $\mu\text{T.y}$ <sup>g</sup>		1.48	(0.51 to 4.24)	1.11	(0.34 to 3.61)

- cancer registration or any part of death certificate coded to ICD-9 205.1.
- one year refers to a working year, approx. 250 8-hour shifts.
- analysed simultaneously with sex and attained age (5 year age groups)
- analysed simultaneously with sex, attained age, calendar period (5 year periods), and negotiating body (NJM, NJB, NJC, NJIC + NJ(B+C)E).
- five exposure categories scored by the mean value in each category, namely 0.76, 3.72, 7.27, 13.92, 38.50  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely 0.71, 3.70, 7.25, 13.75, 37.82  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely zero, 0.19, 1.11, 3.29, 12.26  $\mu\text{T.y}$ .

Table S3. Relative risks of acute myeloid leukaemia (AML)<sup>a</sup> by levels of estimated cumulative magnetic field exposure (four separate analyses), UK electricity generation workers first employed in power stations, 1973-2010.

Exposure to magnetic fields ( $\mu\text{T.y}$ ) <sup>b</sup>	n	RR <sup>c</sup>	(95 % CI)	RR <sup>d</sup>	(95% CI)
<i>Model 1. Occupational cumulative lifetime exposure to magnetic field.</i>					
0-	27	1.0		1.0	
2.5-	9	0.96	(0.45 to 2.06)	1.04	(0.48 to 2.23)
5.0-	14	0.97	(0.50 to 1.88)	1.06	(0.54 to 2.07)
10.0-	16	1.39	(0.73 to 2.63)	1.53	(0.80 to 2.93)
$\geq 20.0$	4	0.81	(0.28 to 2.33)	0.84	(0.29 to 2.45)
RR per 10 $\mu\text{T.y}$ <sup>e</sup>		1.00	(0.78 to 1.27)	1.01	(0.80 to 1.28)
<i>Model 2. Occupational exposure to magnetic fields received more than ten years ago (lagged exposure)</i>					
0-	29	1.0		1.0	
2.5-	10	1.17	(0.56 to 2.43)	1.17	(0.56 to 2.45)
5.0-	14	1.13	(0.58 to 2.22)	1.15	(0.58 to 2.28)
10.0-	14	1.50	(0.75 to 3.00)	1.53	(0.75 to 3.15)
$\geq 20.0$	3	0.79	(0.23 to 2.67)	0.77	(0.22 to 2.73)
RR per 10 $\mu\text{T.y}$ <sup>f</sup>		1.02	(0.79 to 1.33)	1.02	(0.78 to 1.33)
<i>Occupational exposure to magnetic fields received less than ten years ago (lagged exposure)</i>					
Zero	39	1.0		1.0	
0.01-	19	1.28	(0.72 to 2.28)	1.30	(0.70 to 2.42)
0.5-	5	0.75	(0.29 to 1.97)	0.80	(0.27 to 2.34)
2.0-	3	0.52	(0.16 to 1.77)	0.64	(0.17 to 2.39)
$\geq 5.0$	4	0.86	(0.29 to 2.59)	1.05	(0.31 to 3.53)
RR per 10 $\mu\text{T.y}$ <sup>g</sup>		0.79	(0.31 to 2.01)	0.98	(0.37 to 2.57)

- cancer registration or any part of death certificate coded to ICD-9 205.0.
- one year refers to a working year, approx. 250 8-hour shifts.
- analysed simultaneously with sex and attained age (5 year age groups)
- analysed simultaneously with sex, attained age, calendar period (5 year periods), and negotiating body (NJM, NJB, NJC, NJIC + NJ(B+C)E).
- five exposure categories scored by the mean value in each category, namely 0.76, 3.72, 7.27, 13.92, 38.50  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely 0.71, 3.70, 7.25, 13.75, 37.82  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely zero, 0.19, 1.11, 3.29, 12.26  $\mu\text{T.y}$ .

Table S4. Relative risks of chronic lymphatic leukaemia (CLL)<sup>a</sup> by levels of estimated cumulative magnetic field exposure (four separate analyses), UK electricity generation workers first employed in power stations, 1973-2010.

Exposure to magnetic fields ( $\mu\text{T.y}$ ) <sup>b</sup>	n	RR <sup>c</sup>	(95 % CI)	RR <sup>d</sup>	(95% CI)
<i>Model 1. Occupational cumulative lifetime exposure to magnetic field.</i>					
0-	57	1.0		1.0	
2.5-	13	0.61	(0.33 to 1.11)	0.61	(0.33 to 1.11)
5.0-	26	0.73	(0.46 to 1.17)	0.72	(0.45 to 1.16)
10.0-	19	0.65	(0.38 to 1.10)	0.64	(0.38 to 1.09)
$\geq 20.0$	10	0.79	(0.40 to 1.56)	0.79	(0.40 to 1.55)
RR per 10 $\mu\text{T.y}$ <sup>e</sup>		0.93	(0.77 to 1.12)	0.93	(0.77 to 1.12)
<i>Model 2. Occupational exposure to magnetic fields received more than ten years ago (lagged exposure)</i>					
0-	59	1.0		1.0	
2.5-	16	0.81	(0.46 to 1.41)	0.82	(0.47 to 1.43)
5.0-	24	0.81	(0.49 to 1.31)	0.81	(0.49 to 1.32)
10.0-	17	0.76	(0.44 to 1.34)	0.78	(0.44 to 1.37)
$\geq 20.0$	9	1.00	(0.48 to 2.05)	1.04	(0.50 to 2.16)
RR per 10 $\mu\text{T.y}$ <sup>f</sup>		0.96	(0.78 to 1.17)	0.96	(0.78 to 1.17)
<i>Occupational exposure to magnetic fields received less than ten years ago (lagged exposure)</i>					
Zero	93	1.0		1.0	
0.01-	22	0.76	(0.46 to 1.23)	0.76	(0.46 to 1.26)
0.5-	5	0.41	(0.16 to 1.04)	0.39	(0.15 to 1.04)
2.0-	9	0.93	(0.45 to 1.92)	0.84	(0.39 to 1.84)
$\geq 5.0$	6	0.82	(0.34 to 1.97)	0.74	(0.30 to 1.84)
RR per 10 $\mu\text{T.y}$ <sup>g</sup>		0.91	(0.44 to 1.85)	0.89	(0.43 to 1.85)

- cancer registration or any part of death certificate coded to ICD-9 204.1.
- one year refers to a working year, approx. 250 8-hour shifts.
- analysed simultaneously with sex and attained age (5 year age groups)
- analysed simultaneously with sex, attained age, calendar period (5 year periods), and negotiating body (NJM, NJB, NJC, NJIC + NJ(B+C)E).
- five exposure categories scored by the mean value in each category, namely 0.76, 3.72, 7.27, 13.92, 38.50  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely 0.71, 3.70, 7.25, 13.75, 37.82  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely zero, 0.19, 1.11, 3.29, 12.26  $\mu\text{T.y}$ .

Table S5. Relative risks of acute lymphatic leukaemia (ALL)<sup>a</sup> by levels of estimated cumulative magnetic field exposure (four separate analyses), UK electricity generation workers first employed in power stations, 1973-2010.

Exposure to magnetic fields ( $\mu\text{T.y}$ ) <sup>b</sup>	n	RR <sup>c</sup>	(95 % CI)	RR <sup>d</sup>	(95% CI)
<i>Model 1. Occupational cumulative lifetime exposure to magnetic field.</i>					
0-	1	1.0		1.0	
2.5-	3	8.77	(0.91 to 84.5)	8.97	(0.93 to 86.5)
5.0-	1	2.20	(0.14 to 35.6)	2.26	(0.14 to 36.8)
10.0-	3	9.06	(0.91 to 90.2)	9.30	(0.93 to 92.9)
$\geq 20.0$	2	13.56	(1.19 to 155)	13.19	(1.15 to 151)
RR per 10 $\mu\text{T.y}$ <sup>e</sup>		1.58	(1.03 to 2.43)	1.57	(1.02 to 2.41)
<i>Model 2. Occupational exposure to magnetic fields received more than ten years ago (lagged exposure)</i>					
0-	4	1.0		1.0	
2.5-	2	1.90	(0.32 to 11.2)	1.51	(0.25 to 9.02)
5.0-	1	0.75	(0.07 to 7.44)	0.53	(0.05 to 5.52)
10.0-	2	2.16	(0.32 to 14.6)	1.30	(0.17 to 9.89)
$\geq 20.0$	1	2.60	(0.23 to 28.8)	1.20	(0.09 to 16.5)
RR per 10 $\mu\text{T.y}$ <sup>f</sup>		1.32	(0.74 to 2.35)	1.23	(0.67 to 2.26)
<i>Occupational exposure to magnetic fields received less than ten years ago (lagged exposure)</i>					
Zero	2	1.0		1.0	
0.01-	2	2.07	(0.27 to 15.6)	3.10	(0.38 to 25.6)
0.5-	2	3.94	(0.46 to 33.7)	8.50	(0.75 to 96.2)
2.0-	2	4.09	(0.46 to 36.3)	10.10	(0.79 to 129)
$\geq 5.0$	2	4.41	(0.46 to 42.1)	11.74	(0.79 to 176)
RR per 10 $\mu\text{T.y}$ <sup>g</sup>		2.02	(0.51 to 7.99)	2.47	(0.56 to 11.0)

- cancer registration or any part of death certificate coded to ICD-9 204.0.
- one year refers to a working year, approx. 250 8-hour shifts.
- analysed simultaneously with sex and attained age (5 year age groups)
- analysed simultaneously with sex, attained age, calendar period (5 year periods), and negotiating body (NJM, NJB, NJC, NJIC + NJ(B+C)E).
- five exposure categories scored by the mean value in each category, namely 0.76, 3.72, 7.27, 13.92, 38.50  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely 0.71, 3.70, 7.25, 13.75, 37.82  $\mu\text{T.y}$ .
- five exposure categories scored by the mean value in each category, namely zero, 0.19, 1.11, 3.29, 12.26  $\mu\text{T.y}$ .