

## **Supplementary material**

**Health effects of occupational and environmental exposures to nuclear power plants:  
A meta-analysis and meta-regression**

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## Appendix 1 Search strategy

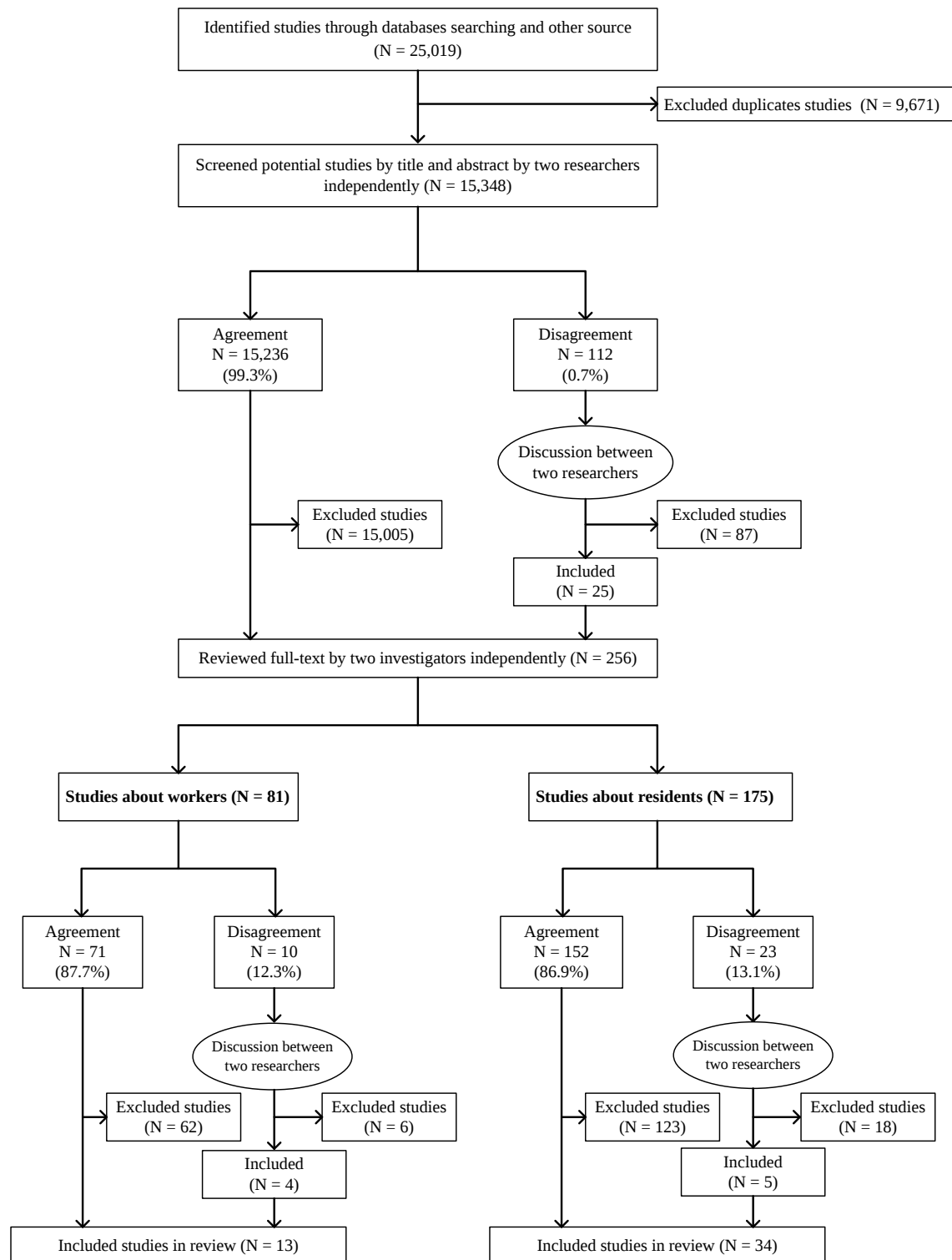
We originally searched studies published before July 28, 2022 in four databases, namely, the Cochrane Library, PubMed, ScienceDirect, and Web of Science. Updated search were conducted on January 13, 2023 to search studies published from July 29, 2022 to January 13, 2023 and second updated were conducted on August 10, 2023 to search studies published from January 13, 2023 to August 10, 2023 [1].

The search terms and filters for our search strategy are presented in Table S1. As ScienceDirect cannot accommodate more than eight Boolean connective words in one search term, we had to conduct three searches. The second search resulted in more than 6,000 results; this search had to be split into two time periods (1950–2010 and 2011–2022) because ScienceDirect can only display 6,000 results per search.

**Table S1. The search terms and filters for search strategy of four databases.**

| Databases               | Search term                                                                                                                                                                                                                                                                                                                                                                                                                                          | Filters for original search                                                                                                                                                                                                                                                                                     | Filters for updated search                                                                                                                                                                                                 | Filters for second updated search                                                                         |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| <b>Cochrane Library</b> | ((("nuclear power plant*" OR "nuclear site*" OR "nuclear power" OR "nuclear facilit*" OR "nuclear industry" OR "nuclear installation*") NOT (accident* OR disaster* OR "nuclear power plant incident*")) AND ((residen* OR worker*) OR (epidemiolog* OR incidence* OR mortality OR death rate OR illness)))                                                                                                                                          | Did not apply (searched until July 28, 2022).                                                                                                                                                                                                                                                                   | Used filter of published years, set from 2022/7 to 2023/2.                                                                                                                                                                 | Used filter of published years, set from 2023/1 to 2023/9.                                                |
| <b>PubMed</b>           | ((("nuclear power plant*" OR "nuclear site*" OR "nuclear power" OR "nuclear facilit*" OR "nuclear industry" OR "nuclear installation*") NOT (accident* OR disaster* OR "nuclear power plant incident*")) AND ((residen* OR worker*) OR (epidemiolog* OR incidence* OR mortality OR death rate OR illness)))                                                                                                                                          | Did not apply (searched until July 28, 2022).                                                                                                                                                                                                                                                                   | Used filter of published years, set from 2022/7/28 to 2023/1/13.                                                                                                                                                           | Used filter of published years, set from 2023/1/13 to 2023/8/10.                                          |
| <b>ScienceDirect</b>    | (1) ("nuclear power plant" OR "nuclear site") AND ((residen OR worker) OR (epidemiolog OR incidence OR mortality OR death rate OR illness))<br><br>(2) ("nuclear power" OR "nuclear facility") AND ((residen OR worker) OR (epidemiolog OR incidence OR mortality OR death rate OR illness))<br><br>(3) ("nuclear industry" OR "nuclear installation") AND ((residen OR worker) OR (epidemiolog OR incidence OR mortality OR death rate OR illness)) | Used research articles as article type filter (searched until July 28, 2022).<br><br>(a) Publication year: "1950–2010" and "2011–2022"<br>(b) Used research articles as article type filter.<br>(searched until July 28, 2022)<br>Used research articles as article type filter (searched until July 28, 2022). | Used research articles as article type filter, and used filter of published years, set from 2022 to 2023.<br><br>Used research articles as article type filter, and used filter of published years, set from 2023 to 2024. | Used research articles as article type filter, and used filter of published years, set from 2023 to 2024. |
| <b>Web of Science</b>   | ((("nuclear power plant*" OR "nuclear site*" OR "nuclear power" OR "nuclear facilit*" OR "nuclear industry" OR "nuclear installation*") NOT (accident* OR disaster* OR "nuclear power plant incident*")) AND ((residen* OR worker*) OR (epidemiolog* OR incidence* OR mortality OR death rate OR illness)))                                                                                                                                          | Did not apply (searched until July 28, 2022).                                                                                                                                                                                                                                                                   | Used filter of published years, set from 2022/7/28 to 2023/1/13.                                                                                                                                                           | Used filter of published years, set from 2023/1/13 to 2023/8/10.                                          |

\*, can be used to search for different spellings of a word.



**Figure S1. The summary of agreement rate of screening and selection process.**  
N, number of studies.

## **Appendix 2 The certainty of evidence**

The certainty of evidence is lowered by the risk of bias, inconsistency of the effect, indirectness, imprecision, and publication bias, all of which lower the certainty rating [1]. Ratings are upgraded in the case of a large effect, a dose-response gradient, or plausible residual opposing confounding [1].

The risk of bias rating for studies of all-cancer risk among workers are mostly categorized as tier 1, and that among residents as tiers 1 or 2, indicating that the risks of bias were “not serious” in workers and “serious” in residents. As the meta-analyses of all-cancer risk among workers and residents revealed “moderate” and “considerable” heterogeneity ( $I^2 = 58.9\%–97.2\%$ ), respectively, the inconsistencies of the effect were “serious” and “very serious”, respectively. The indirectness and imprecision were “not serious” in all instances because our outcomes directly reflected the nuclear power plant-related health of the workers and residents. Egger’s tests revealed evidence of publication bias for all-cancer risk among workers and residents. We did not detect a significant dose-response relationship between dose or average distance from the nuclear power plants and all-cancer risk for workers or residents. Ultimately, the certainties of evidence for all-cancer risk among workers in nuclear power plants and residents living within 30 km of nuclear power plants were “very low.”

**Table S2. The summary of findings of evidence using GRADE of all-cancer among workers in nuclear power plants.**

| Number of studies | Study design          | Certainty assessment |               |              |             |                                                                    | Number of patients              |                      | Effect                      | Certainty        |
|-------------------|-----------------------|----------------------|---------------|--------------|-------------|--------------------------------------------------------------------|---------------------------------|----------------------|-----------------------------|------------------|
|                   |                       | Risk of bias         | Inconsistency | Indirectness | Imprecision | Other considerations                                               | Workers in nuclear power plants | Reference population | Relative risk (RR) (95% CI) |                  |
| 8                 | observational studies | not serious          | serious       | not serious  | not serious | Publication bias: strongly suspected<br>Dose response gradient: no | 10,166                          | 10,233               | RR: 0.85 (0.75–0.97)        | ⊕○○○<br>Very low |

**Table S3. The summary of findings of evidence using GRADE of all-cancer among residents living within 30 km of nuclear power plants.**

| Number of studies | Study design          | Certainty assessment |               |              |             |                                                                    | Number of patients                  |                      | Effect                      | Certainty        |
|-------------------|-----------------------|----------------------|---------------|--------------|-------------|--------------------------------------------------------------------|-------------------------------------|----------------------|-----------------------------|------------------|
|                   |                       | Risk of bias         | Inconsistency | Indirectness | Imprecision | Other considerations                                               | Residents near nuclear power plants | Reference population | Relative risk (RR) (95% CI) |                  |
| 14                | observational studies | serious              | very serious  | not serious  | not serious | Publication bias: strongly suspected<br>Dose response gradient: no | 167,030                             | 208,892              | RR: 1.05 (1.00–1.09)        | ⊕○○○<br>Very low |

GRADE, Grading of Recommendations Assessment, Development, and Evaluation; CI, confidence interval

### Appendix 3 The formulae for data extraction

(1) The formula for estimating the exposure indicators

- a. We collected data about average cumulative dose (millisieverts [mSv]) and duration of occupational exposure to radiation (years) to calculate the value of average annual cumulative dose (mSv/year). The formula we used is as follows:

$$D \text{ (mSv/year)} = \frac{d \text{ (mSv)}}{t \text{ (years)}} \quad (\text{Equation 1})$$

Where D is average annual cumulative dose (mSv/year), d is average cumulative dose (mSv) and t is duration of occupational exposure to radiation (years).

- b. We collected data about average distance from nuclear power plants (km). The formula we used is as follows:

$$d_{\text{average}} \text{ (km)} = \frac{d_{\text{min}} \text{ (km)} + d_{\text{max}} \text{ (km)}}{2} \quad (\text{Equation 2})$$

Where  $d_{\text{average}}$  is average distance from nuclear power plants (km),  $d_{\text{min}}$  is the minimum distance of residential range which study had defined near nuclear power plants (km) and  $d_{\text{max}}$  is the maximum distance of residential range which study had defined near nuclear power plants (km).

(2) The formula for estimating or transforming to relative risk (RR)

As the studies did not directly provide the estimates of RR or presented other outcome indicators, we used the following methods to calculate RR:

- a. For studies in which details of the population size were provided, we used the following formula [2]:

$$RR = \frac{\left(\frac{a}{a+b}\right)}{\left(\frac{c}{c+d}\right)} \quad (\text{Equation 3})$$

Where a is the number of people who were exposed to nuclear power plants and developed diseases, b is the number of people who were exposed to nuclear power plants but did not develop diseases, c is the number of people who were not exposed to nuclear power plants but developed diseases, and d is the number of people who were not exposed to nuclear power plants and did not develop diseases.

- b. The studies provided the value of odds ratio (OR), we use the following formula [3]:

$$RR = \frac{OR}{(1-r)+(r \times OR)} \quad (\text{Equation 4})$$

Where r is the incidence rate or mortality rate of diseases in population not exposed to nuclear power plants, and OR is the value of OR from the original article.

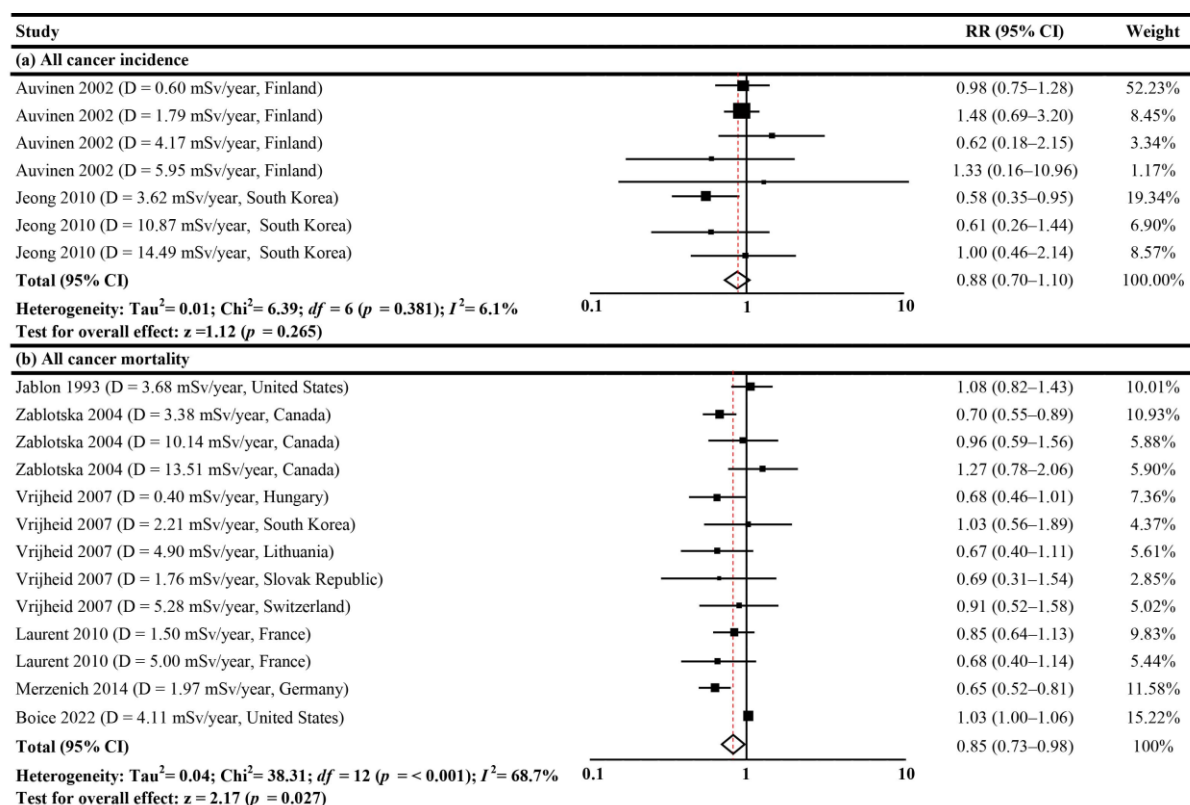
If the studies did not provide the SE or 95% CI, we calculated the SE and 95% CI for the natural logarithm of relative risks using following formula [2]:

$$SE \text{ of } \ln RR \text{ (SE)} = \sqrt{\frac{1}{a} - \frac{1}{a+c} + \frac{1}{b} - \frac{1}{b+d}} \quad (\text{Equation 5})$$

$$95\% \text{ CI of } \ln RR = \ln RR \pm 1.96 \times SE \quad (\text{Equation 6})$$

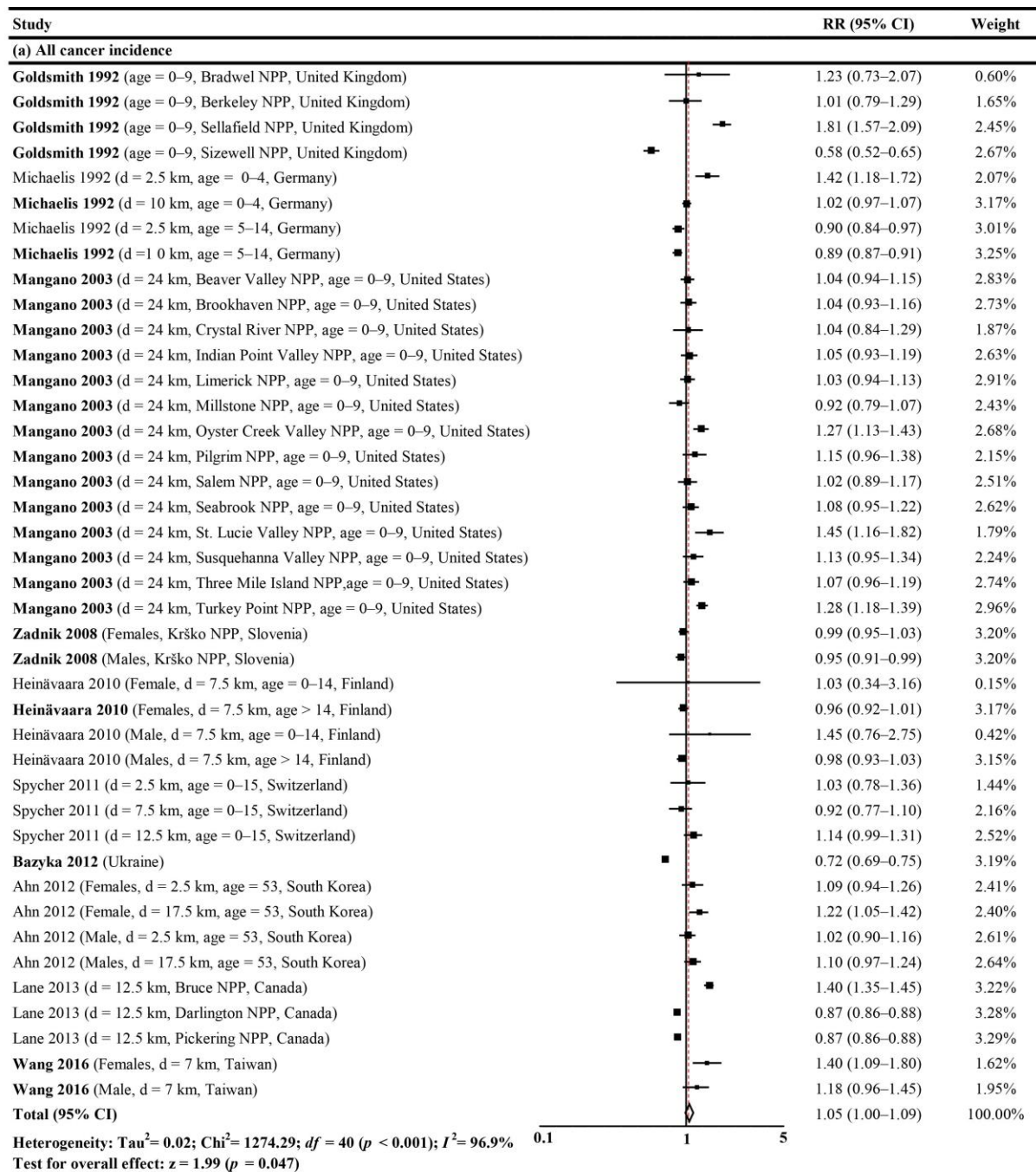
Where a is the number of people who were exposed to nuclear power plants and developed diseases, b is the number of people who were exposed to nuclear power plants but did not develop diseases, c is the number of people who were not exposed to nuclear power plants but developed diseases, and d is the number of people who were not exposed to nuclear power plants and did not develop diseases.

## Appendix 4 Forest plots of pooled relative risk for all-cancer

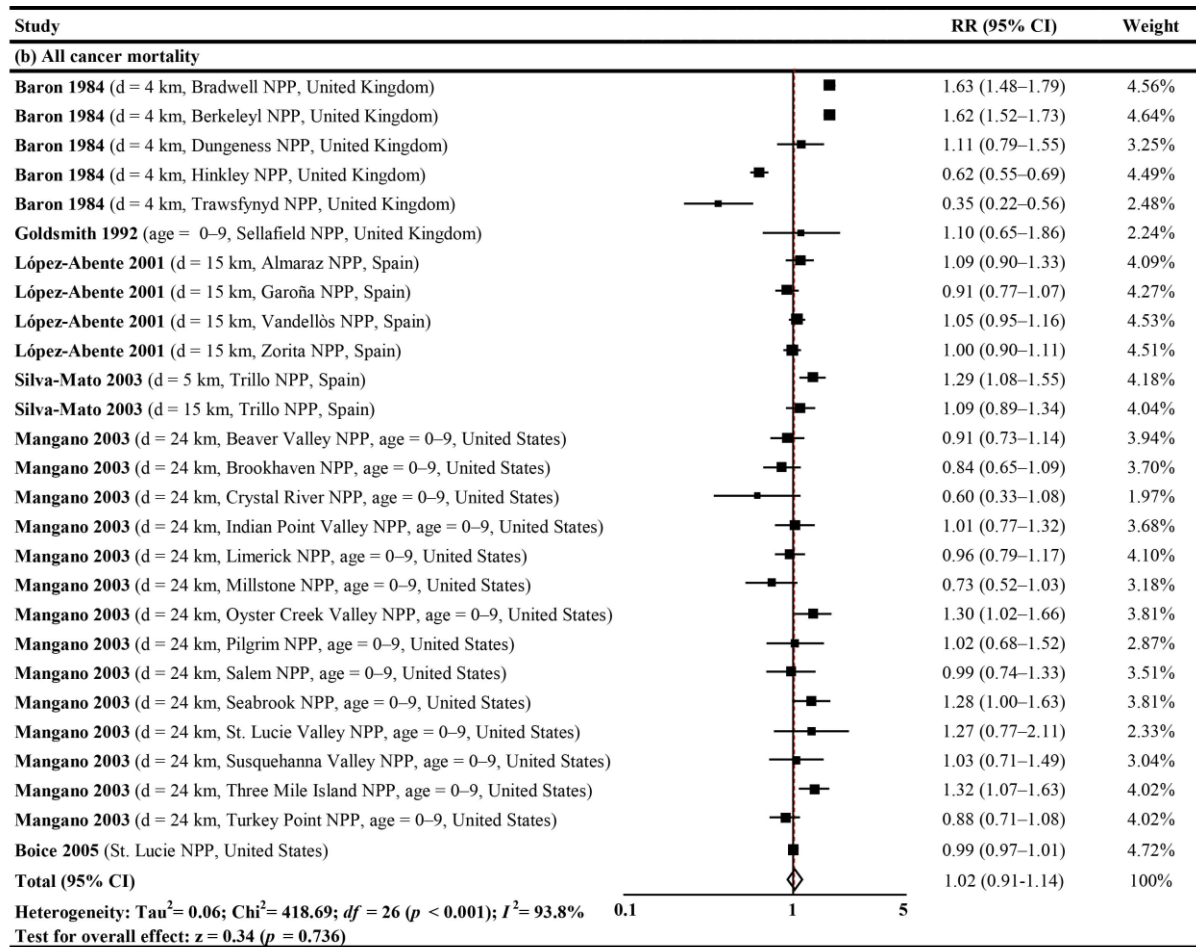


**Figure S2. Forest plots of studies on the relative risk of all cancer (a) incidence and (b) mortality among workers in nuclear power plants compared with population without or with the lowest occupational exposure to radiation from nuclear power plants.**

D, average annual cumulative dose of radiation exposure workers had exposed (mSv/year); mSv/year, millisievert per year; RR, relative risk; CI, confidence interval;  $df$ , degrees of freedom;  $I^2$ , I-squared;  $z$ , Z-score;  $p$ , P-value.



**Figure S3. Forest plots of studies on the relative risk of all-cancer incidence among residents living within 30 km of nuclear power plants compared with those living farther than 30 km from nuclear power plants.** d, average residential distance from nuclear power plants (km); age, average age of population; NPP, nuclear power plant; km, kilometer; RR, relative risk; CI, confidence interval;  $df$ , degrees of freedom;  $I^2$ , I-squared;  $z$ , Z-score;  $p$ , P-value.



**Figure S4. Forest plots of studies on the relative risk of all-cancer mortality among residents living within 30 km of nuclear power plants compared with those living farther than 30 km from nuclear power plants.** d, average residential distance from nuclear power plants (km); age, average age of population; NPP, nuclear power plant; km, kilometer; RR, relative risk; CI, confidence interval;  $df$ , degrees of freedom;  $I^2$ , I-squared;  $z$ , Z-score;  $p$ , P-value.

## Appendix 5 Statistical analysis of subgroup analyses

**Table S4. Pooled relative risk of subgroup analyses for all-cancer among workers in nuclear power plants. compared with population without or with the lowest occupational exposure to radiation from nuclear power plants.**

| Characteristics                                                        | Number of study groups | Pooled RR (95% CI) | P-value* | I <sup>2</sup> (95% CI) | P-value† |
|------------------------------------------------------------------------|------------------------|--------------------|----------|-------------------------|----------|
| <b>Overall</b>                                                         | 20                     | 0.85 (0.75–0.97)   | 0.013    | 58.9% (0.0%–81.9%)      | <0.001   |
| <b>Geographic area</b>                                                 |                        |                    |          |                         |          |
| America                                                                | 5                      | 0.97 (0.81–1.16)   | 0.714    | 62.1% (0.0%–88.0%)      | 0.032    |
| Asia                                                                   | 4                      | 0.75 (0.55–1.03)   | 0.076    | 0.0% (0.0%–66.4%)       | 0.412    |
| Europe                                                                 | 11                     | 0.79 (0.69–0.88)   | <0.001   | 2.4% (0.0%–52.4%)       | 0.419    |
| <b>Average cumulative dose of radiation exposure (mSv)</b>             |                        |                    |          |                         |          |
| 0 ≤ dose <25                                                           | 6                      | 0.96 (0.80–1.14)   | 0.625    | 8.7% (0.0%–64.5%)       | 0.361    |
| 25 ≤ dose <50                                                          | 7                      | 0.71 (0.62–0.80)   | <0.001   | 0.0% (0.0%–37.7%)       | 0.719    |
| 50 ≤ dose <75                                                          | 2                      | 1.03 (1.00–1.06)   | 0.040    | 0.0% (0.0%–0.0%)        | 0.813    |
| 75 ≤ dose <100                                                         | 2                      | 0.86 (0.56–1.31)   | 0.477    | 0.0% (0.0%–75.0%)       | 0.373    |
| dose ≥100                                                              | 3                      | 0.95 (0.64–1.43)   | 0.814    | 33.0% (0.0%–81.9%)      | 0.225    |
| <b>Average annual cumulative dose of radiation exposure (mSv/year)</b> |                        |                    |          |                         |          |
| 0 ≤ dose rate <5                                                       | 13                     | 0.83 (0.71–0.97)   | 0.019    | 71.1% (0.0%–88.9%)      | <0.001   |
| 5 ≤ dose rate <10                                                      | 3                      | 0.79 (0.55–1.15)   | 0.221    | 0.0% (0.0%–55.5%)       | 0.667    |
| dose rate ≥10                                                          | 4                      | 1.01 (0.76–1.36)   | 0.930    | 0.0% (0.0%–57.0%)       | 0.528    |
| <b>Comparator indicators</b>                                           |                        |                    |          |                         |          |
| National population                                                    | 14                     | 0.87 (0.75–1.00)   | 0.052    | 56.9% (0.0%–82.0%)      | 0.004    |
| Workers without or with the lowest occupational exposure to radiation  | 6                      | 0.81 (0.63–1.03)   | 0.082    | 32.8% (0.0%–74.3%)      | 0.190    |
| <b>Years of follow-up</b>                                              |                        |                    |          |                         |          |
| <20 years                                                              | 7                      | 0.68 (0.58–0.80)   | <0.001   | 0.0% (0.0%–35.7%)       | 0.758    |
| ≥20 years                                                              | 13                     | 0.93 (0.83–1.05)   | 0.225    | 37.2% (0.0%–70.9%)      | 0.086    |
| <b>Average age at the end of follow-up</b>                             |                        |                    |          |                         |          |
| <45 years                                                              | 14                     | 0.83 (0.72–0.95)   | 0.0063   | 8.9% (0.0%–52.2%)       | 0.355    |
| ≥45 years                                                              | 6                      | 0.87 (0.71–1.07)   | 0.177    | 76.3% (0.0%–92.5%)      | 0.001    |
| <b>The categorization of the risk of bias</b>                          |                        |                    |          |                         |          |
| Tier 1                                                                 | 13                     | 0.81 (0.70–0.93)   | 0.003    | 27.1% (0.0%–63.3%)      | 0.171    |
| Tier 2                                                                 | 7                      | 0.95 (0.83–1.09)   | 0.482    | 26.0% (0.0%–70.4%)      | 0.230    |

\* P-value show effect of characteristics. † P-value of heterogeneity. mSv, millisievert; mSv/year, millisievert per year; NPP, nuclear power plant; km, kilometer; RR, relative risk; CI, confidence interval; I<sup>2</sup>, I-squared; NA, not applicable

**Table S5. Pooled relative risk of subgroup analyses for all-cancer among residents living within 30 km of the nuclear power plants compared with those living farther than 30 km from nuclear power plants.**

| Characteristics                               | Number of study groups | Pooled RR (95% CI) | P-value* | I <sup>2</sup> (95% CI) | P-value† |
|-----------------------------------------------|------------------------|--------------------|----------|-------------------------|----------|
| <b>Overall</b>                                | 53                     | 1.05 (1.00–1.09)   | 0.045    | 97.2% (75.6%–99.0%)     | <0.001   |
| <b>Geographic area</b>                        |                        |                    |          |                         |          |
| America                                       | 18                     | 1.07 (1.00–1.13)   | 0.046    | 98.2% (46.1%–99.5%)     | <0.001   |
| Asia                                          | 6                      | 1.13 (1.05–1.22)   | 0.001    | 27.5% (0.0%–71.9%)      | 0.228    |
| Europe                                        | 29                     | 1.02 (0.93–1.10)   | 0.727    | 96.4% (87.9%–98.3%)     | <0.001   |
| <b>Average age of study population</b>        |                        |                    |          |                         |          |
| 0 ≤ age <5                                    | 20                     | 1.09 (1.00–1.17)   | 0.0498   | 88.5% (66.9%–94.3%)     | <0.001   |
| 5 ≤ age <10                                   | 7                      | 0.95 (0.88–1.04)   | 0.256    | 61.2% (0.0%–87.2%)      | 0.017    |
| age ≥10                                       | 6                      | 1.03 (0.96–1.10)   | 0.321    | 63.8% (0.0%–87.5%)      | 0.017    |
| Not specified                                 | 20                     | 1.93 (0.97–1.10)   | 0.397    | 98.7% (73.4%–99.6%)     | <0.001   |
| <b>Sex</b>                                    |                        |                    |          |                         |          |
| Females                                       | 6                      | 1.06 (0.98–1.15)   | 0.177    | 72.2% (0.0%–91.9%)      | 0.003    |
| Males                                         | 6                      | 1.01 (0.95–1.07)   | 0.809    | 52.2% (0.0%–83.7%)      | 0.063    |
| Not specified                                 | 41                     | 1.04 (0.99–1.09)   | 0.127    | 97.7% (71.9%–99.3%)     | <0.001   |
| <b>Study types</b>                            |                        |                    |          |                         |          |
| Case-control study                            | 2                      | 1.20 (1.01–1.41)   | 0.035    | 32.3% (0.0%–86.5%)      | 0.224    |
| Cohort study                                  | 27                     | 1.01 (0.96–1.08)   | 0.657    | 92.8% (63.3%–97.0%)     | <0.001   |
| Ecologic study                                | 24                     | 1.06 (0.99–1.13)   | 0.082    | 98.4% (46.4%–99.6%)     | <0.001   |
| <b>Exposure indicators</b>                    |                        |                    |          |                         |          |
| Community/district                            | 17                     | 1.04 (0.92–1.18)   | 0.556    | 97.8% (81.4%–99.2%)     | <0.001   |
| Distance                                      | 36                     | 1.05 (1.00–1.09)   | 0.032    | 96.5% (40.6%–98.9%)     | <0.001   |
| <b>Average distance from NPP (km)*</b>        |                        |                    |          |                         |          |
| 0 ≤ distance <10                              | 18                     | 1.07 (0.93–1.23)   | 0.340    | 95.9% (81.2%–98.3%)     | <0.001   |
| 10 ≤ distance <20                             | 13                     | 1.03 (0.96–1.11)   | 0.364    | 98.4% (22.6%–99.6%)     | <0.001   |
| 20 ≤ distance <30                             | 15                     | 1.08 (1.02–1.13)   | 0.007    | 79.4% (0.0%–91.5%)      | <0.001   |
| Not specified                                 | 7                      | 0.94 (0.79–1.12)   | 0.504    | 97.0% (34.0%–99.1%)     | <0.001   |
| <b>The categorization of the risk of bias</b> |                        |                    |          |                         |          |
| Tier 1                                        | 15                     | 1.03 (0.98–1.07)   | 0.245    | 37.8% (0.0%–68.6%)      | 0.069    |
| Tier 2                                        | 38                     | 1.05 (1.00–1.10)   | 0.076    | 97.9% (77.3%–99.3%)     | <0.001   |

\* P-value show effect of characteristics. † P-value of heterogeneity. mSv, millisievert; mSv/year, millisievert per year; NPP, nuclear power plant; km, kilometer; RR, relative risk; CI, confidence interval; I<sup>2</sup>, I-squared; NA, not applicable

## Appendix 6 Summarization of basic characteristics of included studies

**Table S6. Basic characteristics of the studies for workers in nuclear power plants included in meta-analysis.**

| Number | Author              | Year | Study type         | Country (Region/ NPP)                                                                 | Study period | Main exposure indicator | Definition of research and reference population                                                                                                                                                                                                     | Outcome indicator              | Outcome diseases we collected                                                                                                                               |
|--------|---------------------|------|--------------------|---------------------------------------------------------------------------------------|--------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Jablon et al.[4]    | 1993 | Cohort study       | Calvert Cliffs NPP, Calvert Count, the United States                                  | 1969–1988    | Cumulative dose         | <b>Research population:</b><br>male workers in the Calvert Cliffs NPP, the United States<br><br><b>Reference population:</b><br>national population in the United States                                                                            | <b>Mortality:</b> SMR          | All-cancer<br>Lung cancer<br>Leukemia<br>Circulatory disease<br>Digestive disease<br>Respiratory disease                                                    |
| 2      | Auvinen et al.[5]   | 2002 | Cohort study       | Loviisa and Olkiluoto NPPs, Finland                                                   | 1967–1998    | Cumulative dose         | <b>Research population:</b><br>workers in the Loviisa and Olkiluoto NPPs, Finland<br><br><b>Reference population:</b><br>general population in Finland                                                                                              | <b>Incidence:</b> SIR          | All-cancer                                                                                                                                                  |
| 3      | Zablotska et al.[6] | 2004 | Cohort study       | Five NPPs (Point Lepreau, Hydro-Québec, Pickering, Darlington and Bruce NPPs), Canada | 1957–1994    | Cumulative dose         | <b>Research population:</b><br>workers in the Canadian National Dose Registry<br><br><b>Reference population:</b><br>Canadian population during 1957–1994 for external comparisons and the lowest dose group (<1.0 mSv) for internal comparison     | <b>Mortality:</b> RR, SMR, ERR | All-cancer<br>Esophageal cancer<br>Colon cancer<br>Brain and CNS cancer<br>Leukemia<br>Lung cancer<br>Pancreatic cancer<br>Prostate cancer<br>Rectal cancer |
| 4      | Kindler et al.[7]   | 2006 | Case-control study | Greifswald NPP, Greifswald, Germany                                                   | 1980–2004    | Cumulative dose         | <b>Research population:</b><br>workers based on the Study of Health in Pomerania in the Greifswald NPP, Germany<br><br><b>Reference population:</b><br>workers based on the Study of Health in Pomerania who did not expose to radiation in Germany | <b>Incidence:</b> OR           | Thyroid nodules                                                                                                                                             |

| Number | Author                | Year | Study type   | Country<br>(Region/ NPP)                                                                                                                                                                                            | Study period                                                                                                                                                                                    | Main exposure<br>indicator | Definition of research<br>and reference population                                                                                                                                                                                                                                                               | Outcome indicator         | Outcome diseases<br>we collected                                                          |
|--------|-----------------------|------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|-------------------------------------------------------------------------------------------|
| 5      | Vrijheid<br>et al.[8] | 2007 | Cohort study | Australia,<br>Belgium,<br>Canada<br>Finland,<br>France,<br>Hungary,<br>Japan,<br>South Korea,<br>Lithuania,<br>The Slovak Republic,<br>Spain,<br>Sweden,<br>Switzerland,<br>The United Kingdom<br>The United States | 1972–1998<br>1969–1994<br>1956–1994<br>1971–1997<br>1968–1994<br>1985–1998<br>1986–1992<br>1992–1997<br>1984–2000<br>1973–1993<br>1970–1996<br>1954–1996<br>1969–1995<br>1955–1992<br>1943–1997 | Cumulative dose            | <b>Research population:</b><br>workers in nuclear<br>installations in 15<br>countries<br><br><b>Reference population:</b><br>national population in each<br>15 countries                                                                                                                                         | <b>Mortality:</b> RR, SMR | All-cancer                                                                                |
| 6      | Cardis<br>et al.[9]   | 2007 | Cohort study | Australia,<br>Belgium,<br>Canada<br>Finland,<br>France,<br>Hungary,<br>Japan,<br>South Korea,<br>Lithuania,<br>The Slovak Republic,<br>Spain,<br>Sweden,<br>Switzerland,<br>The United Kingdom<br>The United States | 1972–1998<br>1969–1994<br>1956–1994<br>1971–1997<br>1968–1994<br>1985–1998<br>1986–1992<br>1992–1997<br>1984–2000<br>1973–1993<br>1970–1996<br>1954–1996<br>1969–1995<br>1955–1992<br>1943–1998 | Cumulative dose            | <b>Research population:</b><br>workers in nuclear<br>installations in 15<br>countries<br><br><b>Reference population:</b><br>national population in each<br>15 countries                                                                                                                                         | <b>Mortality:</b> RR, ERR | Lung cancer                                                                               |
| 7      | Jeong<br>et al.[10]   | 2010 | Cohort study | South Korea                                                                                                                                                                                                         | 1992–2005                                                                                                                                                                                       | Cumulative dose            | <b>Research population:</b><br>nuclear power workers,<br>who were issued with a<br>dosimeter at nuclear power<br>facilities at any time<br>during 1978–2005 in South<br>Korea<br><br><b>Reference population:</b><br>workers who did not<br>expose to radiation in<br>nuclear power facilities in<br>South Korea | <b>Incidence:</b> RR, SIR | All-cancer<br>Leukemia<br>Liver cancer<br>Lung cancer<br>Stomach cancer<br>Thyroid cancer |

| Number | Author                  | Year | Study type   | Country<br>(Region/ NPP)                                                 | Study period | Main exposure<br>indicator | Definition of research<br>and reference population                                                                                                                                                                                                                                                    | Outcome indicator                 | Outcome diseases<br>we collected                                                                                                                                                                                                                       |
|--------|-------------------------|------|--------------|--------------------------------------------------------------------------|--------------|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8      | Laurent<br>et al.[11]   | 2010 | Cohort study | France                                                                   | 1961–2003    | Cumulative dose            | <b>Research population:</b><br>workers of the French<br>National Electricity<br>Company<br><br><b>Reference population:</b><br>national population in<br>France                                                                                                                                       | <b>Mortality:</b> RR              | All-cancer<br>Brain and CNS cancer<br>Colon cancer<br>Leukemia<br>Lung cancer<br>Pancreatic cancer<br>Prostate cancer<br>Stomach cancer<br>Rectal cancer<br>Cerebrovascular disease<br>Circulatory disease<br>Digestive disease<br>Respiratory disease |
| 9      | Merzenich<br>et al.[12] | 2014 | Cohort study | Germany                                                                  | 1991–2008    | Cumulative dose            | <b>Research population:</b><br>workers in 17 NPPs in<br>west Germany<br><br><b>Reference population:</b><br>general population in west<br>Germany                                                                                                                                                     | <b>Mortality:</b> SMR, HR         | All-cancer<br>Brain and CNS cancer<br>Colon cancer<br>Leukemia<br>Lung cancer<br>Mesothelioma<br>Pancreatic cancer<br>Prostate cancer<br>Stomach cancer                                                                                                |
| 10     | Azizova<br>et al.[13]   | 2018 | Cohort study | Mayak nuclear installation and<br>Sellafield NPPs, the United<br>Kingdom | 1947–2005    | Cumulative dose            | <b>Research population:</b><br>workers in the Mayak<br>nuclear installation and the<br>Sellafield NPP, the United<br>Kingdom<br><br><b>Reference population:</b><br>workers who exposed dose<br>less than 5 mSv in the<br>Mayak nuclear installation<br>and the Sellafield NPP, the<br>United Kingdom | <b>Mortality:</b> RR, ERR         | Cerebrovascular disease<br>Circulatory disease                                                                                                                                                                                                         |
| 11     | Boice<br>et al.[14]     | 2022 | Cohort study | The United States                                                        | 1957–2011    | Cumulative dose            | <b>Research population:</b><br>workers in 52 NPPs in the<br>United States<br><br><b>Reference population:</b><br>general population in the<br>United States                                                                                                                                           | <b>Mortality:</b> SMR, HR,<br>ERR | All-cancer<br>Brain and CNS cancer<br>Colon cancer<br>Leukemia<br>Lung cancer<br>Pancreatic cancer<br>Prostate cancer<br>Rectal cancer<br>Stomach cancer                                                                                               |

| Number | Author           | Year | Study type   | Country (Region/ NPP) | Study period | Main exposure indicator | Definition of research and reference population                                                                                                 | Outcome indicator         | Outcome diseases we collected                                                        |
|--------|------------------|------|--------------|-----------------------|--------------|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------|
| 12     | Kudo et al.[15]  | 2022 | Cohort study | Japan                 | 2005–2010    | Cumulative dose         | <b>Research population:</b> workers in 17 NPPs in Japan<br><br><b>Reference population:</b> the workers exposed lowest dose (<5.0 mSv)          | <b>Mortality:</b> RR      | Cerebrovascular disease<br>Circulatory disease<br>Respiratory disease<br>Lung cancer |
| 13     | Mumma et al.[16] | 2022 | Cohort study | The United States     | 1969–2011    | Cumulative dose         | <b>Research population:</b> workers in 52 NPPs in the United States<br><br><b>Reference population:</b> general population in the United States | <b>Mortality:</b> SMR, HR | Mesothelioma                                                                         |

NPP, nuclear power plant; CNS, central nervous system; mSv, millisievert; RR, relative risk; OR, odds ratio; SMR, standard mortality rate; SIR, standard incidence rate; ERR, excess relative risk; HR, hazard ratio.

**Table S7. Basic characteristics of the studies for residents living near nuclear power plants included in meta-analysis.**

| Number | Author              | Year | Study type         | Country (Region/ NPP)                                                                                                       | Study period | Main exposure indicator | Definition of research and reference population                                                                                                                                                                                | Outcome indicator     | Outcome diseases we collected                                            |
|--------|---------------------|------|--------------------|-----------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|--------------------------------------------------------------------------|
| 1      | Enstrom et al.[17]  | 1983 | Ecologic study     | San Onofre NPP, California, the United States                                                                               | 1960–1978    | Distance                | <p><b>Research population:</b><br/>population living near the San Onofre NPP, the United States</p> <p><b>Reference population:</b><br/>population living farther than 25 miles from the San Onofre NPP, the United States</p> | <b>Mortality:</b> SMR | Leukemia                                                                 |
| 2      | Baron et al.[18]    | 1984 | Ecologic study     | 18 nuclear installations (six NPPs: Bradwell, Berkeley, Hinkley, Dungeness, Trawsfynydd, Sizewell NPPs), the United Kingdom | 1950–1979    | Community/district      | <p><b>Research population:</b><br/>population living near the 18 nuclear installations (within a 5-mile radius), the United Kingdom</p> <p><b>Reference population:</b><br/>national population in the United Kingdom</p>      | <b>Mortality:</b> SMR | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer |
| 3      | Ewings et al.[19]   | 1989 | Cohort study       | Hinkley NPP, Somerset, the United Kingdom                                                                                   | 1959–1986    | Distance                | <p><b>Research population:</b><br/>population living near the Hinkley NPP, the United Kingdom</p> <p><b>Reference population:</b><br/>population living farther than 15.625 km from the Hinkley NPP, the United Kingdom</p>    | <b>Incidence:</b> SIR | Leukemia                                                                 |
| 4      | Urquhart et al.[20] | 1991 | Case-control study | Dounreay NPP, Caithness, the United Kingdom                                                                                 | 1968–1986    | Distance                | <p><b>Research population:</b><br/>population living near the Dounreay NPP, the United Kingdom</p> <p><b>Reference population:</b><br/>population living farther than 25 km from the Dounreay NPP, the United Kingdom</p>      | <b>Incidence:</b> OR  | Leukemia                                                                 |

| Number | Author                | Year | Study type         | Country (Region/ NPP)                                                                                                                                                | Study period                                               | Main exposure indicator | Definition of research and reference population                                                                                                                                                                 | Outcome indicator                              | Outcome diseases we collected                                                              |
|--------|-----------------------|------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------|
| 5      | Michaelis et al.[21]  | 1992 | Cohort study       | 18 NPPs, west Germany                                                                                                                                                | 1980–1990                                                  | Distance                | <b>Research population:</b><br>population living near the 18 NPPs, west Germany<br><br><b>Reference population:</b><br>population living in comparison area in west Germany defined in studies                  | <b>Incidence:</b> RR, SIR                      | All-cancer<br>Acute leukemia                                                               |
| 6      | Goldsmith et al.[22]  | 1992 | Cohort study       | 23 nuclear installations (seven NPPs: Sellafield, Bradwell, Berkeley, Hinkley, Dungeness, Trawsfynydd, Sizewell NPPs), the United Kingdom                            | 1971–1980                                                  | Community/district      | <b>Research population:</b><br>population living near the seven NPPs, the United Kingdom<br><br><b>Reference population:</b><br>population living in comparison area in the United Kingdom defined in studies   | <b>Mortality:</b> SMR<br><b>Incidence:</b> SIR | <b>Incidence:</b><br>All-cancer<br>Leukemia<br><b>Mortality:</b><br>All-cancer<br>Leukemia |
| 7      | McLaughlin et al.[23] | 1993 | Ecologic study     | Five nuclear installations (two NPPs: Pickering and Bruce NPPs), Canada                                                                                              | 1971–1987 (for Pickering NPP)<br>1967–1987 (for Bruce NPP) | Distance                | <b>Research population:</b><br>children, aged 0–14 years living in five areas of the province that contain nuclear facilities in Canada<br><br><b>Reference population:</b><br>children in the province, Canada | <b>Mortality:</b> SMR<br><b>Incidence:</b> SIR | <b>Incidence:</b> Leukemia<br><b>Mortality:</b> Leukemia                                   |
| 8      | Hattchouel et al.[24] | 1995 | Cohort study       | 13 nuclear installations (12 NPPs: Blayais, Bugey, Chinon, Chooz, Cruas, Dampierre, Fessenheim, Gravelines, Marcoule, Paluel, St-Laurent and Tricastin NPPs), France | 1968–1989                                                  | Distance                | <b>Research population:</b><br>population, aged 0–24 years living near 13 nuclear installations, France<br><br><b>Reference population:</b><br>national population in France                                    | <b>Mortality:</b> SMR                          | Leukemia                                                                                   |
| 9      | Morris et al.[25]     | 1996 | Case-control study | Pilgrim NPP, Massachusetts, the United States                                                                                                                        | 1978–1986                                                  | Distance                | <b>Research population:</b><br>population living near the Pilgrim NPP, the United States<br><br><b>Reference population:</b><br>population living farther than 37 km from the                                   | <b>Incidence:</b> OR                           | Leukemia                                                                                   |

| Number | Author                  | Year | Study type         | Country (Region/ NPP)                                                                                                         | Study period | Main exposure indicator | Definition of research and reference population                                                                                                                                                          | Outcome indicator                                | Outcome diseases we collected                                            |
|--------|-------------------------|------|--------------------|-------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------|
|        |                         |      |                    |                                                                                                                               |              |                         | Pilgrim NPP, the United States                                                                                                                                                                           |                                                  |                                                                          |
| 10     | López-Abente et al.[26] | 1999 | Cohort study       | 13 nuclear installations (seven NPPs: Zorita, Santa María de Garoña, Vandellós, Almaraz, Ascó, Cofrentes, Trillo NPPs), Spain | 1975–1993    | Distance                | <b>Research population:</b> population living near the 13 nuclear installations, Spain<br><br><b>Reference population:</b> population living farther than 50 km from the 13 nuclear installations, Spain | <b>Mortality:</b> RR, SMR                        | Leukemia                                                                 |
| 11     | López-Abente et al.[27] | 2001 | Cohort study       | 12 nuclear installations (four NPPs: Zorita, Santa María de Garoña, Vandellós, Almaraz NPPs), Spain                           | 1975–1993    | Distance                | <b>Research population:</b> population living near the 12 nuclear installations, Spain<br><br><b>Reference population:</b> population living farther than 50 km from the 12 nuclear installations, Spain | <b>Mortality:</b> RR, SMR                        | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer |
| 12     | Silva-Mato et al.[28]   | 2003 | Case-control study | Zorita and Trillo NPPs, Spain                                                                                                 | 1988–1999    | Community/district      | <b>Research population:</b> population living near the Zorita and Trillo NPPs, Spain<br><br><b>Reference population:</b> population living farther than 30 km from the Zorita and Trillo NPPs, Spain     | <b>Mortality:</b> OR                             | All-cancer                                                               |
| 13     | Mangano et al.[29]      | 2003 | Ecologic study     | 14 NPPs, the eastern United States                                                                                            | 1988–1997    | Distance                | <b>Research population:</b> population living within 30 miles (48 km) of 14 NPPs, the eastern United States<br><br><b>Reference population:</b> national population in the United States                 | <b>Mortality:</b> Rate<br><b>Incidence:</b> Rate | <b>Incidence:</b> All-cancer<br>Leukemia<br><b>Mortality:</b> All-cancer |

| Number | Author                  | Year | Study type         | Country (Region/ NPP)                                                                                                                                                                                                                        | Study period | Main exposure indicator | Definition of research and reference population                                                                                                                                                                                 | Outcome indicator           | Outcome diseases we collected                                                              |
|--------|-------------------------|------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|--------------------------------------------------------------------------------------------|
| 14     | White-Koning et al.[30] | 2004 | Cohort study       | 29 nuclear installations (19 NPPs: Belleville, Bugey, Cattenom, Chinon, Chooz, Civaux, Cruas, Dampierre, Fessenheim, Flamanville, Golfech, Gravelines, Le Blayais, Nogent, Paluel, Penly, St. Alban, St. Laurent and Tricastin NPPs), France | 1990–1998    | Distance                | <b>Research population:</b> population living within 20 km of 29 nuclear installations, included 19 NPPs, France<br><br><b>Reference population:</b> national population in France                                              | <b>Incidence:</b> SIR       | Leukemia                                                                                   |
| 15     | Yoshimoto et al.[31]    | 2004 | Ecologic study     | 16 NPPs (Tokai, Fugen, Mihama, Fukushima I, Takahama, Shimane, Genkai, Hamaoka, Ikata, Oi, Fukushima II, Onagawa, Sendai, Kashiwazaki-kariwa, Tomari and Shika NPPs), Japan                                                                  | 1972–1997    | Community/district      | <b>Research population:</b> population living near 16 NPPs, Japan<br><br><b>Reference population:</b> population living in comparison community/district in Japan defined in studies                                            | <b>Mortality:</b> Rate, ERR | Leukemia                                                                                   |
| 16     | Boice et al.[32]        | 2005 | Cohort study       | St. Lucie NPP, Florida, the United States                                                                                                                                                                                                    | 1950–2000    | Community/district      | <b>Research population:</b> population living near the St. Lucie NPP, the United States<br><br><b>Reference population:</b> population living in comparison community/district (Polk and Volusia Counties) in the United States | <b>Mortality:</b> RR, SMR   | All-cancer<br>Leukemia                                                                     |
| 17     | Kaatsch et al.[33]      | 2008 | Case-control study | 16 NPPs, Germany                                                                                                                                                                                                                             | 1980–2003    | Distance                | <b>Research population:</b> population living near the 16 NPPs, Germany<br><br><b>Reference population:</b> population living farther than 70 km from 16 NPPs, Germany                                                          | <b>Incidence:</b> OR, SIR   | Leukemia                                                                                   |
| 18     | Zadnik et al.[34]       | 2008 | Ecologic study     | Krško NPP, Krško, Slovenia                                                                                                                                                                                                                   | 1984–2003    | Community/district      | <b>Research population:</b> population living near the Krško NPP, Slovenia<br><br><b>Reference population:</b> population in other 11                                                                                           | <b>Incidence:</b> RR        | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer<br>Thyroid cancer |

| Number | Author                | Year | Study type                                           | Country (Region/ NPP)                                                                                                                                 | Study period                        | Main exposure indicator | Definition of research and reference population                                                                                                                                                                     | Outcome indicator             | Outcome diseases we collected |
|--------|-----------------------|------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|-------------------------------|
|        |                       |      |                                                      |                                                                                                                                                       |                                     |                         | Slovenian statistical regions                                                                                                                                                                                       |                               |                               |
| 19     | Spix et al.[35]       | 2009 | Case-control study                                   | 16 NPPs, Germany                                                                                                                                      | 1993–2003                           | Community/district      | <b>Research population:</b> children aged <5 years living near 16 NPPs, Germany<br><br><b>Reference population:</b> population living in comparison community/district in Germany                                   | <b>Incidence:</b> OR          | Leukemia                      |
| 20     | Mangano et al.[36]    | 2009 | Cohort study                                         | Seven NPPs (Indian Point, Oyster Creek, Salem/Hope Creek, Limerick, Peach Bottom, Susquehanna, Three Mile Island NPPs), New Jersey, the United States | 2001–2005                           | Distance                | <b>Research population:</b> population living near seven NPPs, the United States<br><br><b>Reference population:</b> national population in the United States                                                       | <b>Incidence:</b> Rate        | Thyroid cancer                |
| 21     | Heinävaara et al.[37] | 2010 | Cohort study<br>Case-control study<br>Ecologic study | Loviisa and Olkiluoto NPPs, Finland                                                                                                                   | 1975–2004<br>1981–2000<br>1977–2004 | Distance                | <b>Research population:</b> population living near the Loviisa and Olkiluoto NPPs, Finland<br><br><b>Reference population:</b> population living farther than 15–50 km from the Loviisa and Olkiluoto NPPs, Finland | <b>Incidence:</b> RR, SIR, OR | All-cancer<br>Leukemia        |
| 22     | Spycher et al.[38]    | 2011 | Cohort study                                         | Five NPPs (Beznau, II, Leibstadt, Mühleberg, Gösgen NPPs), Switzerland                                                                                | 1985–2009                           | Distance                | <b>Research population:</b> children, aged 0–15 living near five NPPs, Switzerland<br><br><b>Reference population:</b> children, aged 0–15 living farther than 15 km from five NPPs, Switzerland                    | <b>Incidence:</b> Rate, RR    | All-cancer<br>Leukemia        |

| Number | Author                   | Year | Study type         | Country (Region/ NPP)                                                                                                                                                      | Study period | Main exposure indicator | Definition of research and reference population                                                                                                                                                                    | Outcome indicator             | Outcome diseases we collected                                                              |
|--------|--------------------------|------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------------------------------------------------------------------------------|
| 23     | Ma et al.[39]            | 2011 | Cohort study       | Seven NPPs (Braidwood, Byron, Clinton, Dresden, LaSalle, Quad Cities, Zion NPPs), Illinois, the United States                                                              | 1986–2005    | Distance                | <b>Research population:</b> children, aged 0–14 living near seven NPPs, the United States<br><br><b>Reference population:</b> population in Illinois, the United States                                            | <b>Incidence:</b> RR, SIR     | Leukemia                                                                                   |
| 24     | Bazyka et al.[40]        | 2012 | Cohort study       | Khmelnyskyi and Zaporizhzhia NPPs, Ukraine                                                                                                                                 | 2003–2008    | Community/district      | <b>Research population:</b> population living near the Khmelnyskyi and Zaporizhzhia NPPs, Ukraine<br><br><b>Reference population:</b> population living in regions without cities with nuclear facilities, Ukraine | <b>Incidence:</b> SIR         | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Thyroid cancer                   |
| 25     | Ahn et al.[41]           | 2012 | Cohort study       | Four NPPs (Kori, Wolsong, Hanbit and Hanul NPPs), South Korea                                                                                                              | 1992–2010    | Distance                | <b>Research population:</b> population living near four NPPs, South Korea<br><br><b>Reference population:</b> population living farther than 30 km from four NPPs, South Korea                                     | <b>Incidence:</b> CR, ASR, HR | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer<br>Thyroid cancer |
| 26     | Sermage-Faure et al.[42] | 2012 | Cohort study       | 19 NPPs, France                                                                                                                                                            | 2002–2007    | Distance                | <b>Research population:</b> population living near 19 NPPs, France<br><br><b>Reference population:</b> population living farther than 20 km from 19 NPPs, France                                                   | <b>Incidence:</b> SIR         | Acute leukemia                                                                             |
| 27     | Bithell et al.[43]       | 2013 | Case-control study | 13 NPPs (Bradwell, Berkeley, Chapelcross, Hinkley, Hartlepool, Heysham, Hunterston, Dungeness, Oldbury, Torness, Trawsfynydd, Sizewell and Wylfa NPPs), the United Kingdom | 1962–2007    | Distance                | <b>Research population:</b> population living near 13 NPPs, the United Kingdom<br><br><b>Reference population:</b> population living farther than 25 km from 13 NPPs, the United Kingdom                           | <b>Incidence:</b> OR          | Leukemia                                                                                   |

| Number | Author               | Year | Study type     | Country (Region/ NPP)                                                       | Study period                                                                                     | Main exposure indicator | Definition of research and reference population                                                                                                                                                           | Outcome indicator         | Outcome diseases we collected                                                              |
|--------|----------------------|------|----------------|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--------------------------------------------------------------------------------------------|
| 28     | Lane et al.[44]      | 2013 | Ecologic study | Three NPPs (Pickering, Bruce and Darlington NPPs), Ontario, Canada          | 1990–2008                                                                                        | Distance                | <b>Research population:</b><br>population living near three NPPs, Canada<br><br><b>Reference population:</b><br>general population in Ontario, Canada                                                     | <b>Incidence:</b> SIR     | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer<br>Thyroid cancer |
| 29     | Bollaerts et al.[45] | 2014 | Ecologic study | Five nuclear installations (three NPPs: Doel, Tihange, Chooz NPPs), Belgium | 2000–2008, 2004–2008                                                                             | Distance                | <b>Research population:</b><br>population living near five nuclear installations, Belgium<br><br><b>Reference population:</b><br>national population in Belgium                                           | <b>Incidence:</b> RR, SIR | Thyroid cancer                                                                             |
| 30     | Wang et al.[46]      | 2016 | Cohort study   | Three NPPs (Jinshan, Kuosheng, Maanshan NPPs), Taiwan                       | 1979–2003                                                                                        | Community/district      | <b>Research population:</b><br>population living near three NPPs, Taiwan<br><br><b>Reference population:</b><br>population living farther than 22.76 km from three NPPs, Taiwan                           | <b>Incidence:</b> RR      | All-cancer<br>Breast cancer<br>Leukemia<br>Lung cancer<br>Stomach cancer<br>Thyroid cancer |
| 31     | Khomenko et al.[47]  | 2017 | Ecologic study | Zaporizhzhia NPP, Ukraine                                                   | 2003–2015                                                                                        | Community/district      | <b>Research population:</b><br>population living near the Zaporizhzhia NPP, Dnipropetrovsk region, Ukraine<br><br><b>Reference population:</b><br>general population living in Petrivsk district, Ukraine | <b>Incidence:</b> Rate    | Digestive disease                                                                          |
| 32     | Demoury et al.[48]   | 2017 | Ecologic study | Four nuclear installations (two NPPs: Doel and Tihange NPPs), Belgium       | 2000–2014 (the Flemish Region)<br>2004–2014 (the Brussels-Capital Region and the Walloon Region) | Distance                | <b>Research population:</b><br>population living near four nuclear installations, Belgium<br><br><b>Reference population:</b><br>national population in Belgium                                           | <b>Incidence:</b> RR      | Thyroid cancer                                                                             |

| Number | Author                | Year | Study type     | Country (Region/ NPP)                                                                            | Study period | Main exposure indicator | Definition of research and reference population                                                                                                     | Outcome indicator    | Outcome diseases we collected |
|--------|-----------------------|------|----------------|--------------------------------------------------------------------------------------------------|--------------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-------------------------------|
| 33     | Desbiolles et al.[49] | 2018 | Ecologic study | Seven NPPs (Blayais, Bugey, Civaux, Fessenheim, Flamanville, Saint-Alban and Chooz NPPs), France | 1995–2011    | Distance                | <b>Research population:</b><br>population living near seven NPPs, France<br><br><b>Reference population:</b><br>national population in France       | <b>Incidence:</b> RR | Thyroid cancer                |
| 34     | Demoury et al.[50]    | 2021 | Ecologic study | Four nuclear installations (two NPPs: Doel and Tihange NPPs), Belgium                            | 2006–2016    | Distance                | <b>Research population:</b><br>population four nuclear installations, Belgium<br><br><b>Reference population:</b><br>national population in Belgium | <b>Incidence:</b> RR | Leukemia                      |

NPP, nuclear power plant; RR, relative risk; OR, odds ratio; SMR, standard mortality rate; SIR, standard incidence rate; ERR, excess relative risk; CR, crude ratio; ASR, age standardized ratio; HR, hazard ratio.

## Appendix 7 Risk of bias

We used the National Toxicology Program Office of Health Assessment and Translation (NTP/OHAT) risk of bias tool to assess the risk of bias [51]. For workers, no adjustments were performed for confounders, such as lifestyle, occupational exposure to radiation, and socioeconomic status, in four studies; therefore confounding bias was rated as “probably high” for those studies [4, 8, 9, 14]. For exposure and outcome detection bias, most of the studies were rated as “definitely low” and “probably low”. In summary, regarding workers, nine studies were categorized as tier 1 and four as tier 2. For residents, no adjustments were performed for confounders, such as lifestyle and socioeconomic status, in most studies, or adjustment was performed for only one or two demographic factors; confounding bias was rated as “probably high” for those studies. For exposure and outcome detection bias, data from trustworthy databases were used in all of the studies; hence they were all rated as “definitely low” and “probably low”. The conflict of interest in one study resulted in a rating of “definitely high” for the risk of bias [43]. For other studies that did not provide conflict of interest information, we rated “probably high”. In summary, regarding residents, 12 studies were categorized as tier 1 and 22 as tier 2.

We downgraded confidence owing to the risk of bias across studies based on the guideline in the NTP/OHAT risk of bias tool, as follows [51]:

- a. Not likely: Most information is derived from tier 1 studies (low risk of bias for all key domains).
- b. Serious: Most information is derived from tier 1 and 2 studies.
- c. Very serious: The proportion of information from tier 3 studies (at high risk of bias for all key domains) is sufficient to affect the interpretation of results.

**Table S8. Risk of bias of individual studies of workers in nuclear power plants according the NTP/OHAT risk of bias tool.**

(1) Jablon et al. 1993[4]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                            |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the 8,954 male workers in Calvert Cliffs nuclear power plant in the United States (US), who were employed at any time up to the end of 1984. The information of expected risk was based on national death rates. The subject came from the same cohort. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                            |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age. They did not adjust for other potential confounding factor.                                                                                                                                                                                  |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                            |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                            |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | These measurements of dose were from film badges or other dosimeters.                                                                                                                                                                                                      |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The vital status was determined from the Social Security Administration records and the National Death Index.                                                                                                                                                              |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                            |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                           |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                            |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>Data was collected from the staff of the Calvert Cliffs nuclear power plant which made records available for the study.                                                                                                                                   |

## (2) Auvinen et al. 2002[5]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                              |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the 15,619 workers in two nuclear power plants in Finland, who had been monitored for radiation exposure for at least six months.<br>The reference population was defined as general population in Finland.<br>The subject was came from the same cohort. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                              |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for sex, educational level, type of employment, and smoking and alcohol consumption.<br>They did not adjust for other potential confounding factor.                                                                                                     |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                              |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Total 119 of 15,619 subjects had emigrated during the follow-up and their follow-up ended at emigration.                                                                                                                                                                     |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                              |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Both of the power companies used their own dosimetry service and reported the results to the National Registry of Occupational Radiation Exposure.                                                                                                                           |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The data of death were classified by the Finnish Cancer Registry.                                                                                                                                                                                                            |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                              |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                          |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                              |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was supported in part by grants from the Duodecim Society and the Finnish Cancer Society.                                                                                                                                                         |

(3) Zablotska et al. 2004[6]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 45,656 workers in the Canadian National Dose Registry (NDR), had to be monitored in a nuclear facility in Canada for one year.<br>The reference population was defined as Canadian population during 1957-1994 for external comparisons and the lowest dose group (<1.0 mSv) for internal comparisons.                                                                                                                                                                                                                                                      |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex, calendar year, facility types, socioeconomic status, and duration of monitoring.                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Total 188 out of 45,656 workers were excluded because of irregularities in their records, leaving a cohort for analysis of 45,468.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Most Canadian companies in the NDR reported thresholds were generally 0.2 mSv, and doses below this level were recorded as zero dose, but the exception was the Atomic Energy of Canada Limited, where from 1972 to 1994 the threshold was set at 0.05 mSv. No attempts were made to correct for the potential underestimation of dose where the doses were recorded as zero. However, the authors thought that the latest report from the International Agency for Research on Cancer suggests that the impact of measurement errors in dosimetry is likely to be very small. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The data of outcome was classified based on the 9 <sup>th</sup> version of the International Classification of Diseases (ICD).                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SMR, ERR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was funded for record linkage and other resources by the Health Canada.                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(4) Kindler et al. 2006[7]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                    |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 71 workers based on the Study of Health in Pomerania (SHIP), in nuclear power plants, Energiewerke Nord, who were 38 to 57 years of age.<br>The reference population were also based on the SHIP and was defined as 670 males aged between 38 and 57 years without occupational exposure to ionizing radiation. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                    |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, educational level, smoking status, and medical histories on thyroid disorders.                                                                                                                                                                                                                       |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                    |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                      |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                    |
| 4.1 Can we be confident in the exposure characterization?                                       | Probably low   | The cumulative lifetime radiation dose of each employee was obtained from individual dosimetry records provided by the radiation protection department of the Energiewerke Nord.                                                                                                                                                   |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The outcomes were performed thyroid ultrasonography using an ultrasound VST-gateway with a linear array transducer. All examinations were carried out by the same observers. Thyroid volume was calculated as length width depth 0.479 milliliter for each lobe.                                                                   |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                    |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                 |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                    |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was funded by the Federal Ministry of Education and Research (grant no. ZZ9603), the Ministry of Cultural Affairs as well as the Social Ministry of the Federal State of Mecklenburg West Pomerania.                                                                                                    |

(5) Vrijheid et al. 2007[8]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included cohorts of workers in the nuclear industry in 15 countries (Australia, Belgium, Canada, Finland, France, Hungary, Japan, Korea, Lithuania, the Slovak Republic, Spain, Sweden, Switzerland, the United Kingdom [UK] and the US).                                                                                                              |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age, sex, smoking status, and socioeconomic status.<br>They did not adjust for other potential confounding factor.                                                                                                                                                                                                                      |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | For each cohort, if workers were known to have been involved in a radiation incident or accident or have exceptionally high annual doses would be excluded from analyses.                                                                                                                                                                                        |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 4.1 Can we be confident in the exposure characterization?                                       | Probably low   | Dosimetry information was collected from records of individual facilities and/or national dose registries.                                                                                                                                                                                                                                                       |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Causes of death were therefore provided in the 6 <sup>th</sup> , 7 <sup>th</sup> , 8 <sup>th</sup> , 9 <sup>th</sup> , and 10 <sup>th</sup> versions of the ICD, depending on year and country.                                                                                                                                                                  |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SMR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                          |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                  |
| 6.1 Conflict of interest                                                                        | Definitely low | No other authors have conflicts of interest to declare.<br>Financial support for coordination of the International Study was provided by the European Union (contracts F13P-CT930066, F14P CT96-0062, FIGH-CT1999-20001), the US. Centers for Disease Control and Prevention (Co-operative agreement U50/CCU011778), and the Canadian Nuclear Safety Commission. |

(6) Cardis et al. 2007[9]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                     |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included cohorts of workers in the nuclear industry in 15 countries (Australia, Belgium, Canada, Finland, France, Hungary, Japan, Korea, Lithuania, the Slovak Republic, Spain, Sweden, Switzerland, the UK and the US).                                  |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                     |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for smoking status, and socioeconomic status.<br>They did not adjust for other potential confounding factor.                                                                                                                                   |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                     |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | For each cohort, if workers were known to have been involved in a radiation incident or accident or have exceptionally high annual doses would be excluded from analyses.                                                                                           |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                     |
| 4.1 Can we be confident in the exposure characterization?                                       | Probably low   | Dosimetry information was collected from records of individual facilities and/or national dose registries.                                                                                                                                                          |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The information of vital status and date and cause of death for workers who had died were collected by each cohort member at the national level.                                                                                                                    |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                     |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, ERR and 90% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                             |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                     |
| 6.1 Conflict of interest                                                                        | Definitely low | No other authors have conflicts of interest to declare.<br>Financial support for coordination of the International Study was provided by the European Union (contracts F13PCT930066, F14P-CT96-0062, FIGH-CT1999-20001) and the Canadian Nuclear Safety Commission. |

## (7) Jeong et al. 2010[10]

| Domains:                                                                                        | Rating         | Comments                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                               |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 8,429 nuclear power workers in Korea, who were issued with a dosimeter at nuclear power facilities at any time during 1978–2005 and were called “radiation workers”.<br>In addition, 7,807 non-radiation workers in nuclear power facilities in Korea were also included in the study as comparison group. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                               |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, birth year, monitoring status and smoking status.                                                                                                                                                                                                                                               |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                               |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Females were excluded from the present study to focus on male subjects leaving a cohort for analysis of 16,236 male workers.                                                                                                                                                                                                  |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                               |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The study used the radiation exposure database of the Korea Hydro & Nuclear Power Co., Ltd. because it provided whole dose records from 1978, and more detailed information such as radiation type (photon or neutron) and exposure type (internal or external) for each record.                                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The cancer incidence status was evaluated for the period of January 1, 1992 to December 31, 2005, the sites of cancer incidence were based on the 10 <sup>th</sup> version of the ICD codes, and the date of cancer diagnosis was extracted from the Korean Central Cancer Registry.                                          |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                               |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                       |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                               |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was supported by a grant of the Korean Ministry of Education, Science and Technology (KOSEF 2009-0062385) and partially by a grant of the Korea Hydro & Nuclear Power Co., Ltd. (E07NS55).                                                                                                        |

(8) Laurent et al. 2010[11]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                     |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included workers of the French National Electricity Company (EDF), who had been monitored for exposure to ionizing radiation between 1961 and 1994.                                                                                                                                       |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                     |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex and calendar period, educational level, and smoking status.                                                                                                                                                                                                       |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                     |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Workers flagged as substantially exposed to neutrons were excluded from the main analysis.                                                                                                                                                                                                          |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                     |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The measurement of external exposure to high-energy photon radiation (gamma rays, energy range 100–3,000 kiloelectron-volt) was used personal Kodak type two film badge dosimeters, which were worn on the chest. dosimeter calibration systems in use at EDF changed over time.                    |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The causes of death coded according to the 8 <sup>th</sup> version of the ICD for period of 1968–1978, the 9 <sup>th</sup> version of the ICD for period of 1979–1999 and the 10 <sup>th</sup> version of the ICD for period of 2000–2003 were obtained from the National Causes of Death Registry. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                     |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, 90% CI and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                             |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                     |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was funded by the Électricité de France.                                                                                                                                                                                                                                 |

(9) Merzenich et al. 2014[12]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                    |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included workers in 17 nuclear power plants in West Germany, who were eligible for four inclusion criteria. The reference population was defined as the general population of West Germany.                                                                              |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                    |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age and duration of employment, and smoking and alcohol consumption. They did not adjust for other potential confounding factor.                                                                                                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                    |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | For workers lost to follow-up, the end of follow-up was defined as the date of death or last information date. Seventy workers (0.7% of all workers included) were lost to follow-up.                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                    |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The data of individual dosimeters was monitored by officially approved film badges from external high-energy photon radiation.                                                                                                                                                     |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The causes of death were coded by the Statistical Office of Rhineland Palatinate according to the 9 <sup>th</sup> revision of the ICD for deaths in the period of 1991 to 1997 and according to the 10 <sup>th</sup> revision of the ICD for deaths in the period of 1998 to 2008. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                    |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR, HR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                               |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                    |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was funded by the Berufsgenossenschaft Energie Textil Elektro Medienerzeugnisse (BGETEM).                                                                                                                                                               |

## (10) Azizova et al. 2018[13]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                            |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                     |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 22,374 workers for Mayak worker cohort (MWC) and 23,443 workers for Sellafield worker cohort (SWC).                                                                                                                                                                                                              |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                     |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for sex, attained age, calendar period, migration status, external gamma-ray dose and dose from internal alpha radiation, and smoking and alcohol consumption.                                                                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                     |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | For the MWC, workers with unknown vital status, and for the SWC, workers with unknown vital status and those who had emigrated from the UK were defined as workers lost to follow-up.<br>The proportion of lost to follow-up were 5% and 2% for the MWC and SWC respectively.                                                       |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                     |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | For external gamma rays and internal alpha-radiation doses, the measurement systems for MWC and SWC were clearly defined in study.                                                                                                                                                                                                  |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Causes of death were coded consistently in both cohorts in accordance with the 9 <sup>th</sup> version of the ICD. Mortality risk was investigated for all circulatory disease (ICD-9: 390–459 codes), as well as for ischemic heart disease (ICD-9: 410–414 codes) and cerebrovascular disease (ICD-9: 430–438 codes), separately. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                     |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, ERR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                             |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                     |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was funded by the European Union Seventh Framework Programme under Grant Agreement No. 249675 "Epidemiological Studies of Exposed Southern Urals Populations".                                                                                                                                          |

## (11) Boice et al. 2022[14]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                          |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 1,065,703 workers employed at nuclear power plants in the United States in 1957 through 2011 was available for study: 1,001,958 workers within the Radiation Exposure Information and Reporting System (REIRS) maintained by the NRC and 63,745 workers within the Landauer, Inc. dosimetry database. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                          |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for sex, year of birth, duration of monitoring, and socioeconomic status. They did not adjust for other potential confounding factor.                                                                                                                                                               |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                          |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Workers were excluded if the date of first monitoring was after 1984 (n = 592,935) or if personal identifiers needed for tracing, specifically a Social Security Number (n = 5,738) were absent.                                                                                                                         |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                          |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The data of annual individual dosimeters records were available from the REIRS and Landauer files.                                                                                                                                                                                                                       |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The causes of death were coded according to the 8 <sup>th</sup> , 9 <sup>th</sup> and 10 <sup>th</sup> versions of the ICD.                                                                                                                                                                                              |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                          |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR, HR, ERR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                          |
| 6.1 Conflict of interest                                                                        | Definitely low | No potential conflict of interest was reported by the authors.                                                                                                                                                                                                                                                           |

## (12) Kudo et al. 2022[15]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the workers based on the cohort study of cancer mortality among Japanese nuclear workers, who were registered in the Radiation Dose Registry Center (RADREC) within the Radiation Effects Association as of the end of March 1999. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for several variables of lifestyle, socioeconomic status, and there was indirect evidence to indicate adjusted for confounding factor.                                                                                           |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Female workers were excluded from the analysis. Workers who are unable to be identified in the RADREC, no answers written in the questionnaire, and no follow-up period were excluded.                                                                |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The data of individual dosimeters records were supplied by the RADREC.                                                                                                                                                                                |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The causes of death were coded according to the 10 <sup>th</sup> version of the ICD.                                                                                                                                                                  |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                       |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was fully funded by the Nuclear Regulation Authority of Japan.                                                                                                                                                             |

## (13) Mumma et al. 2022[16]

| Domains                                                                                         | Rating          | Comments                                                                                                                                                                                                                                                |
|-------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                 |                                                                                                                                                                                                                                                         |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low  | The study was formed by combining two occupational cohorts, which were drawn from either the US Nuclear Regulatory Commission and the Radiation Exposure Information and Reporting System database or the electronic records of Landauer, Incorporated. |
| <b>2. Confounding bias</b>                                                                      |                 |                                                                                                                                                                                                                                                         |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low    | The authors adjusted for sex, year of birth, potential occupational exposure to asbestos, and year of first radiation monitoring.<br>Using indicates measures to derive smoking and socioeconomic status data.                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                 |                                                                                                                                                                                                                                                         |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low  | Follow-up within the first 10 years of radiation exposure were excluded in the internal Cox analyses.                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                 |                                                                                                                                                                                                                                                         |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low  | The data of individual dosimeters records were from the US Department of Energy (DOE) Radiation Exposure Monitoring Systems dosimetry database, historical DOE study databases as well as the US military service dosimetry databases.                  |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low  | The causes of death were coded according to the 8 <sup>th</sup> , 9 <sup>th</sup> , and 10 <sup>th</sup> versions of the ICD.                                                                                                                           |
| <b>5. Selective reporting bias</b>                                                              |                 |                                                                                                                                                                                                                                                         |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low  | The outcome has been reported in SMR, HR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                 |
| <b>6. Other bias</b>                                                                            |                 |                                                                                                                                                                                                                                                         |
| 6.1 Conflict of interest                                                                        | Definitely high | The authors declared that “only two authors (one is first author) have previously consulted with a former manufacturer of products containing asbestos on matters related to litigation.”, and other authors report no conflict of interest.            |

**Table S9. Risk of bias of individual studies of residents living near nuclear power plants according the NTP/OHAT risk of bias tool.**

(1) Enstrom et al. 1983[17]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included residents living within 25 miles of the San Onofre nuclear and the personal data were collected from the Vital Statistics of California reactor from same period and region.                                                                                                                                                       |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                                                                                                                                                                                                                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Deaths of unknown age and the Pendleton division, consisting of the Camp Pendleton Marine Corps Reservation, has been excluded because it has a highly transient population of young recruits undergoing advanced training and no leukemia deaths were reported among persons under age 20 with Camp Pendleton as a place of residence were excluded. |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The death tapes were then processed using the Statistical Analysis System (SAS) to obtain deaths by sex, race, five-year age group, year of death, cause of death, and county of residence.                                                                                                                                                           |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The death tapes including each California resident death in the period of 1960 to 1978 were obtained from the Vital Statistics Branch of the California Department of Health Services in Sacramento and the underlying cause of death for each death was assigned by the California Vital Statistics Branch nosologist using the ICD.                 |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR and 95%CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                    |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This research has been supported by National Cancer Institute Preventive Oncology Academic Award CA00748 and by Southern California Edison Company.                                                                                                                                                                                  |

(2) Baron et al. 1984[18]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the cancer mortality data examined for the small area (within a 5-mile radius) around 14 nuclear and five non-nuclear facilities in England and Wales.<br>Expected numbers of deaths were obtained by multiplying England and Wales death rates for a given year by the estimated age/sex-specific populations of the local authority areas. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                                                                                                                                                                                                                                                    |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The areas included must covered at least one local authority and all geographic units used were as defined prior to the 1974 local government reorganization (i.e. the Population Statistics Division, and the Office of Population Censuses and Surveys).                                                                                                      |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The cause of death designations utilized were the ICD codes as employed by Office of Population Censuses and Surveys. Six ICD versions were used during the time span considered (ICD-4-9).                                                                                                                                                                     |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                        |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                 |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was partially supported by the Milbank Memorial Fund, and by BRSG2 S07 RR05392-22 awarded by the Biomedical Research Support Grant Program, Division of Research Resources, National Institutes of Health.                                                                                                                          |

(3) Ewings et al. 1989[19]

| Domains                                                                                         | Rating         | Comments                                                                                                                               |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                        |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included residents surrounding Hinkley Point in Somerset down and were recruited from the year, age, and sex.                |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                        |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and sex.<br>They did not adjust for other potential confounding factor.                                   |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                        |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                          |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                        |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The information of smallest areas for which population were identified with postcode areas on the Scottish Cancer Registry since 1968. |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The data of cases were obtained from the South Western Regional Cancer Registry.                                                       |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                        |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.    |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                        |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                          |

(4) Urquhart et al. 1991[20]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | All registered cases of leukemia and non-Hodgkin's lymphoma in children resident in Caithness during 1968–1986 were included in the study. As controls, the authors selected children who were matched with case children according to sex and date of birth. The controls were also matched according to mother's area of residence at birth; for this purpose, Caithness was divided into two zones: (a) the area within 25 km of the Dounreay nuclear installation and (b) the remainder of Caithness. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age, caesarean section, breast feeding, birth weight, and smoking during pregnancy. They did not adjust for other potential confounding factors.                                                                                                                                                                                                                                                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Control child data were excluded if they had left the Caithness area before the date of diagnosis for the matched case all results for that control relating to the period after birth were excluded from the analysis.                                                                                                                                                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Information was collected from each parent by experienced interviewers with a detailed and structured questionnaire. Detailed information was collected for the child and for each parent on all places of residence, on their medical history with particular reference to exposure to x-rays, and on any viral infections.                                                                                                                                                                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The cases included in the study have been the subject of intensive investigation by the Committee on the Medical Aspects of Radiation in the Environment in respect both of completeness of recording and of accuracy of diagnosis.                                                                                                                                                                                                                                                                       |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                                                                                           |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

(5) Michaelis et al. 1992[21]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                        |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included residents in 18 locations of nuclear power plants and two of major research reactors which started their operation between 1960 and 1988 in West Germany. The control regions were recruited from different region with the same period.                                                                                            |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                        |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and smoking status of parents. They did not adjust for other potential confounding factor.                                                                                                                                                                                                                                |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                        |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                          |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                        |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The region of interest around an individual installation was defined first with a radius of 15 km. Communities with at least one-third of their area falling in this circle form the study area for this particular installation. Subregions corresponding to 5 km and 10 km radii of installation were defined in the same way.                       |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | Diagnoses had to be made between January 1, 1980 (the date the registry started its operation) and December 31, 1990. For the six installations which start their operation after January 1, 1980, inclusion of patients from the installation and control regions was restricted to diagnoses established at least one year after the start-up phase. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                        |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SIR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                   |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                        |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                          |

(6) Goldsmith et al. 1992[22]

| Domains                                                                                         | Rating         | Comments                                                                                                                           |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                    |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the subject in the same period (i.e. 1971–1975 and 1976–1980) and same ages (i.e. 0–9 years)                    |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                    |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                       |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                    |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                      |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                    |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The Office of Population Censuses and Surveys (OPCS) data set deals with the information of each site.                             |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The OPCS data set deals with the information of each site.                                                                         |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                    |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and SMR.<br>The outcome provided sufficient data, which could be included in meta-analysis.   |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                    |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was supported in part by a contract with the European Regional Office of the World Health Organization. |

(7) McLaughlin et al. 1993[23]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                           |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included children, aged 0–14 years in five areas of the province that contain nuclear facilities, who died for leukemia in the period of 1950 to 1987, or were diagnosed with leukemia in the period of 1964 to 1986.<br>The expected numbers of events were based on age-specific rates of childhood leukemia in the province. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                           |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and facility types.<br>They did not adjust for other potential confounding factor.                                                                                                                                                                                                                           |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                           |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Total 287 out of 2,181 childhood leukemia deaths and 560 out of 2,374 childhood leukemia incidence were excluded for clear reasons defined by authors.                                                                                                                                                                                    |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                           |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The information of maternal residence at the time of a child's birth was based on Ontario birth certificate.                                                                                                                                                                                                                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Leukemia was defined according to the 9 <sup>th</sup> version of the ICD (204-208 codes).<br>The information of outcome was collected from the Ontario Cancer Registry, which is a provincewide population-based registry.                                                                                                                |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                           |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR, SMR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                  |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                           |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study had financial support was received from the Atomic Energy Control Board of Canada.                                                                                                                                                                                                                             |

(8) Hattchouel et al. 1995[24]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                    |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                             |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The information of cause of each death that occurred in the population aged 0–24 years between 1968 and 1989 by year, zone, sex and five years age groups were collected from the Institut National de la Sante et de la Recherche Médicale (INSERM), service commun no. 8. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                             |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age, sex, facility types and distance from nuclear installations.<br>They did not adjust for other potential confounding factor.                                                                                                                   |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                             |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                               |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                             |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Census data by commune were obtained from the Institut National de la Statistique et des Etudes Economiques, for the four censuses which took place in 1968, 1975, 1982 and 1990.                                                                                           |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The information of cause of each death were collected from the INSERM, service commun no. 8 and were coded according to the 8 <sup>th</sup> and 9 <sup>th</sup> versions of the ICD.                                                                                        |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                             |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SMR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                         |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                             |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This work was partly supported by a grant from CEC NRPB (Contract No. 920064).                                                                                                                                                                             |

## (9) Morris et al. 1996[25]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                      |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included subject in same period and region.                                                                                                                                                                                                |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                      |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex, smoking status, socioeconomic status, and work types.                                                                                                                                                             |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                      |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | There four qualifying towns were excluded because they were included in a cancer study that was conducted concurrently with the Southeastern Massachusetts Health Study.                                                                             |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                      |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The information of historical data pertaining to residence, occupation, health, and socio-demographics were collected from the subjects or their surrogates for deceased subjects during a 45-minute telephone interview conducted by trained staff. |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The information of cases diagnosed were mainly collected from the Massachusetts Cancer Registry.                                                                                                                                                     |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                      |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                      |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                      |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                        |

(10) López-Abente et al. 1999[26]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                               |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | These towns of exposed and reference zones were selected at random from among all of those that met the matching conditions and included 173 and 174 towns, respectively.                                                                                     |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                               |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age, sex, and period.                                                                                                                                                                                                                |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                               |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Three plants were excluded because they were experimental research reactors and a fourth because it came into service in 1993.                                                                                                                                |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                               |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The Universal Transversa Mercator projection centroid coordinates for municipal population centers were furnished by the National Geographical Institute, which were used to measure the distance from the population centroids to the nuclear installations. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The study presents the results on mortality according to the 8 <sup>th</sup> and 9 <sup>th</sup> versions of the ICD.                                                                                                                                         |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                               |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SMR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                          |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                               |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was supported in part by Grant 96/300 from Spain's Fondo de Investigación Sanitaria (Health Research Fund).                                                                                                                        |

(11) López-Abente et al. 2001[27]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | There were 184 towns within 30 km of installation were called the “exposed zone”; and towns there were 178 towns within 50–100 km of the installation were called the “reference zone.”                               |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age, sex, and period.                                                                                                                                                                        |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                         |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors used the Universal Transversa Mercator projection centroid coordinates for towns with a geographic information system to measure the distance from the population centroids to the nuclear installations. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The study presents the results on mortality according to the 9 <sup>th</sup> version of the ICD.                                                                                                                      |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SMR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                  |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was supported in part by Grant 96/300 from Spain’s Fondo de Investigación Sanitaria (Health Research Fund).                                                                                |

## (12) Silva-Mato et al. 2003[28]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included cases were patients with cancer and controls were non-tumorous patients, both admitted to the Guadalajara hospital, who living in the areas within 10, 20, and 30 km of each plant.                                                                                                                                                                                                           |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age, sex, and zones. Using indicates measures to derive smoking.                                                                                                                                                                                                                                                                                                                        |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The information source used for pathology as well as for place of residence is the computerized database of discharge reports from hospital, completed for each patient admitted, provided by the Admission and Clinical Documentation Services of the hospital.<br>The authors performed a clear criterion to evaluate the variable of degree of proximity of place of residence to the nuclear power stations. |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The cases included were all patients with malignant tumors admitted to the Guadalajara hospital in the period of December 27, 1988 to January 16, 1999. Inclusion criteria were admittance for non-secondary malignant tumor pathology, and residence in the province.                                                                                                                                           |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                               |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This research was supported by the University of Alcalá, grant number E017/97.                                                                                                                                                                                                                                                                                                                  |

(13) Mangano et al. 2003[29]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                      |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included childhood age < 10 years in 49 counties who resided in the study counties at the time of diagnosis situated mostly or completely within 30 miles (i.e. 48 km) of the nuclear reactors in the eastern US.<br>The results would compare with national cancer rates. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                      |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                                                                                                                                                                         |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                      |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                        |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                      |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The study used data from some of registries in the eastern United States.                                                                                                                                                                                                            |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The information of childhood cancer mortality data was according to the 9 <sup>th</sup> version of the ICD (140.0–239.9 codes), which was available for all states from 1988 to 1997 and were obtained from the US Centers for Disease Control and Prevention.                       |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                      |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in death rate, incidence rate and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                           |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                      |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                        |

(14) White-Koning et al. 2004[30]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                          |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the incidence of leukemia among children under 15 years of age living within 20 km of 29 nuclear installations in France and used national age-specific incidence rates to derive annual expected numbers of cases for each age group.                                                                                |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                          |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age sex and stratified by distance.                                                                                                                                                                                                                                                                             |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                          |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                            |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                          |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The study areas were constructed as aggregations of the communes whose town hall was within the defined zones.                                                                                                                                                                                                                           |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The information of cases of acute leukemia diagnosed the in period of January 1, 1990 to December 31, 1998 among children aged < 15 years living within the study area at diagnosis were provided by the National Registry of Childhood Leukemia and Lymphoma, which has registered all cases diagnosed in France since January 1, 1990. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                          |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                      |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                          |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was supported by grants from INSERM, the Direction Générale de la Santé, the Ministère de l'Environnement et de l'Aménagement du Territoire and the Fondation pour la Recherche Médicale.                                                                                                                    |

## (15) Yoshimoto et al. 2004[31]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included 20 administrative areas (cities/towns/villages) in Japan where commercial operation of the first reactor started between 1966 and 1993. There 80 control areas were chosen with respect to similarity of administrative area unit, population size, and seashore area so that they could be assumed to have a similar environment/lifestyle, which have distance between nuclear facility and the control areas was about 10–80 km. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The study adjusted for temporal area variations associated with Kyushu and the other five local area blocks and did not for other potential confounding factor.                                                                                                                                                                                                                                                                                        |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Exclude chronic lymphocytic leukemia (CLL) (non-CLL leukemia) and non-Hodgkin's lymphoma mortality.                                                                                                                                                                                                                                                                                                                                                    |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The information of census data (for 1970, 1975, 1980, 1985, 1990, and 1995) were provided by the Statistics Bureau, Management and Coordination Agency, Government of Japan—the present Ministry of Public Management, Home Affairs, Posts and Telecommunications, and linearly interpolated or non-negatively extrapolated numbers were used for each year between 1972 and 1997.                                                                     |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The observed numbers of deaths were counted using the following the ICD codes for vital statistics mortality data provided by the Statistics and Information Department, Minister's Secretariat, Ministry of Health and Welfare.                                                                                                                                                                                                                       |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                                        |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                                                                                                          |

(16) Boice et al. 2005[32]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                             |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                      |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included childhood aged < 20 years in St Lucie County, which located on the east coast of Florida, south of Cape Canaveral.<br>The comparison counties were defined as Polk and Volusia Counties for having similar demographic data with St Lucie County. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                      |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and sex.<br>They did not adjust for other potential confounding factor but chose comparison counties from the same region as the study county helps minimize differences in these and other factors, such as diet and smoking.          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                      |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Analyses excluding the first 10 years after reactor start-up in 1976.                                                                                                                                                                                                |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                      |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The 1990 Census Bureau demographic data on ten socioeconomic variables were obtained for St Lucie County and for all other counties in Florida.                                                                                                                      |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The outcome data was classified by the 8 <sup>th</sup> version of the ICD.                                                                                                                                                                                           |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                      |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SMR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                              |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                      |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was funded, in part, by an agreement with the American Nuclear Insurers.                                                                                                                                                                  |

(17) Kaatsch et al. 2008[33]

| Domains:                                                                                        | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the cases of all the children under 5 years of age in 41 administrative districts in the vicinity of 16 nuclear power plants in western Germany.<br>For every case, three sex- and age-matched controls were randomly selected from the same district in the year of diagnosis, which totally included 4,735 controls.                                                                                                                                    |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors did not adjust for potential confounding factor.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | For both cases and controls the residential address at the time of diagnosis was geo-coded and the distance “r” to the outlet tower of the nearest nuclear power plant established.<br>The model that authors used to estimate the radiation exposure was according to the United Nations Scientific Committee on the Effects of Atomic Radiation, which included the function of distance from a corresponding point source, and was as a variable in the regression model. |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The information of cases was on the basis of data from the German Childhood Cancer Registry.                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR, SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                                                      |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare that no conflict of interest exists according to the guidelines of the International Committee of Medical Journal Editors.<br>The study was supported by the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety and the Federal Office for Radiation Protection (BfS) for financing the KiKK study (project no. StSch 4334) and to the Expert Commission of the BfS.                                                           |

## (18) Zadnik et al. 2008[34]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included data of risk in same period in Spodnjeposavska statistical region, where Brežice municipality and Krško nuclear power plant are situated and were compared with risk for other 11 Slovenian statistical regions.                                                                                                                                              |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age. They did not adjust for other potential confounding factor.                                                                                                                                                                                                                                                                                        |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | The cases of CLL were excluded as authors thought CLL is less inducible by ionizing radiation than other types of leukemia.                                                                                                                                                                                                                                                      |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Cancer incidence data including cancer site, sex, age at diagnosis, and place of residence at the time of diagnosis were collected for two time periods: 1970–1983 and 1984–2003 and provided by the Cancer Registry of Slovenia.                                                                                                                                                |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The data on cancer incidence was obtained from the population-based Cancer Registry of Slovenia, existing since 1950, which main sources are notifications of cancer prescribed by the law. Coding of the information is performed by trained registrars, supervised by a physician. The coding rules and standards are following the World Health Organization recommendations. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                  |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                  |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>The study was financed by the Agency for Radwaste Management of the Republic of Slovenia.                                                                                                                                                                                                                                                                       |

## (19) Spix et al. 2009[35]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the cases aged < 5 years at diagnosis in the period of 1993 to 2003, had been registered at the German. The matching criteria of cases and controls were sex, age, and year of diagnosis. Total 366 cases and 896 controls were available for analysis, these are one to seven controls per case, on average 2.5 controls per case.                                                |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for sex, age, socioeconomic status, duration of pregnancy, birth weight, year at diagnosis, and toxins.                                                                                                                                                                                                                                                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | The reasons of exclusion during matching the cases and controls included non-response, the child received a therapy with ionizing radiation before the diagnosis, suffered from an autoimmune disease, had an organ transplant, regularly took immune suppressive drugs.                                                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The questions of questionnaire referred to social status, potential exposure with ionizing radiation, aspects of pregnancy and birth of the child, activation of the child's immune system and toxins. The questions would use to interview the biological mother and the interviewers were trained in multiple sessions and met regularly for retraining over the about 18 months of the field work. |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The diagnose data were provided by the German Childhood Cancer Registry.                                                                                                                                                                                                                                                                                                                              |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in OR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                       |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare that have no conflict of interest to disclose.                                                                                                                                                                                                                                                                                                                                    |

(20) Mangano et al. 2009[36]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                  |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                           |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the data of thyroid cancer incidence 45 states plus the District of Columbia in same period.                                                                                                                           |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                           |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                                                                                                                              |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                           |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Incidence rates are published only for those counties with at least 15 thyroid cancer cases diagnosed in the period of 2001 to 2005, as rates in less-populated counties are based on small numbers of cases that are often not reliable. |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                           |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The US Centers for Disease Control and Prevention or the National Cancer Institute (NCI).                                                                                                                                                 |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The US Centers for Disease Control and Prevention or the NCI.                                                                                                                                                                             |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                           |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in incidence rate and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                               |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                           |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                             |

## (21) Heinävaara et al. 2010[37]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included subject in same period and region.                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age, sex, socioeconomic status, parents' radiation work, and father's age at child's birth.                                                                                                                                                                                                                                                                                                                                   |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | In case-control analysis:<br>In children, the coordinates of residential history were missing for 8% (i.e. three out of 38 coordinates) of cases and 4% (i.e. five out of 128 coordinates) of controls, and in adults, the corresponding percentages were 6% (i.e. 12 out of 196) and 11% (i.e. 89 out of 828), respectively.<br>The coordinates were missing in children for one case and one control, and in adults for eight cases and 24 controls. |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | Residential histories of all study subjects were obtained from the Population Register Center.                                                                                                                                                                                                                                                                                                                                                         |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Leukemia cases were according to the 10 <sup>th</sup> version of the ICD (C91-95 coded) and were identified from the Finnish Cancer Registry.                                                                                                                                                                                                                                                                                                          |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SIR, OR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                               |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declared that none of the authors have any financial or non-financial competing interests.                                                                                                                                                                                                                                                                                                                                                 |

(22) Spycher et al. 2011[38]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included childhood aged 0–15 who living within 15 km of five nuclear power plants (Beznau I and II, Leibstadt, Mühleberg and Gösgenin) in Switzerland. The reference population was defined as childhood aged 0–15 who living farther than 15 km from five nuclear power plants in Switzerland, which has been adjusted for sex, age and calendar year. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age, sex, and calendar year at diagnosis.                                                                                                                                                                                                                                                                                                |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | The 1,250 and 85 children excluded from birth and resident cohorts, respectively, had higher proportions of lymphomas and bone tumors as they were, on average, older at diagnosis.                                                                                                                                                                               |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors have clearly interpreted the measurement or estimation of exposure assessment and geo-coding in study.                                                                                                                                                                                                                                                |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The data of children diagnosed with cancer in the period of 1985 to 2009 were based on the Swiss Childhood Cancer Registry were eligible, which has completeness of registration is > 90% and were classified according to the 3 <sup>rd</sup> version of the International Classification of Childhood Cancer (ICCC).                                            |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                   |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                   |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare that no conflict of interest in study. This study was supported by the Swiss Federal Office of Public Health (BAG 08.001616) and the Swiss Cancer League (KLS 02224-03-2008).                                                                                                                                                                 |

## (23) Ma et al. 2011[39]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included cancer cases diagnosed in the period of 1986 to 2005 for Illinois children aged 0–14 years. The expected number of cases for each geographic zone was obtained using the Illinois state age-specific cancer incidence for the two periods (i.e. 1986–1995 and 1996–2005) and the corresponding census populations. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age. They did not adjust for other potential confounding factor.                                                                                                                                                                                                                                             |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                         |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors used distance from nuclear power plants to the zone improvement plan code centroid of cancer case residence as the surrogate of exposure, which were calculated using SAS program developed by the North American Association of Central Cancer Registries.                                                               |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Individual-level cancer incidence data were from the Illinois State Cancer Registry and were classified by the 3 <sup>rd</sup> version of the ICCC.                                                                                                                                                                                   |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SIR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                  |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                         |

(24) Bazyka et al. 2012[40]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                              |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the case data of malignant tumors in the population of the listed cities in same period, which were provided from the National Cancer Registry of Ukraine.                |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                              |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age.<br>They did not adjust for other potential confounding factor.                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                              |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Excluded some cities and were listed in table.                                                                                                                                               |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                              |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The study was area-based and the total number of inhabitants of the cities of Nuclear Energy and the reported cancer cases are presented in table.                                           |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The data on primary cancer cases of the National Cancer Registry of Ukraine conducted by the National Cancer Institute were used and were classified by the 10 <sup>th</sup> version of ICD. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                              |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                          |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                              |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified.                                                                                                                                                                               |

(25) Ahn et al. 2012[41]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                     |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                              |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The exposed population were based on the Korea Radiation Effect & Epidemiology Cohort included adult residents living within 5 km of the nuclear power plants. The non-exposed population was set at two different levels of proximity: 5–30 and 30 km from nuclear power plants. Both of them were recruited from same period and region    |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                              |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex, smoking, alcohol drinking, liver disease history, current job, education attainment, total energy expenditure per day, family history of cancer, body mass index, and medical services of x-rays or radiation.                                                                                            |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                              |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Cases with codes other than C00-D09 were excluded from the screening, because a trial sample survey on the probability of having cancer among those cases yielded nil.                                                                                                                                                                       |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                              |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The definition exposed study area was based on the “Act on Support to the around Area of Power Plants”, which was enacted in June 1989.<br>An independent radiological investigation in the residential areas near nuclear power plants, the exposed study areas, by Thermo-luminescence dosimeter at 7-8 spots in each exposed study areas. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The outcome data was defined as C00~D09 according to the 10 <sup>th</sup> version of the ICD-10.                                                                                                                                                                                                                                             |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                              |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in HR, CR and ASR cancer incidence rate and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                         |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                              |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was supported in part by the National Research Foundation of Korea (NRF) funded by the Republic of Korea Government (Ministry of Education, Science and Technology) (No. 2010-0000986).                                                                                                                          |

(26) Sermage-Faure et al. 2012[42]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                               |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                        |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included all the 2,753 French childhood leukemia cases aged up to 15 years at the end of the year of diagnosis, diagnosed in the period of 2002 to 2007, which were obtained from the French National Registry of Childhood Hematopoietic Malignancies (NRCH).                                                               |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                        |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age at the end of the year and some demographic variables.                                                                                                                                                                                                                                                    |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                        |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Analyses were also performed after excluding the subjects living 50 km from nuclear power plants in the case-control study and computing the incidence between 20 and 50 km.                                                                                                                                                           |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                        |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The addresses of the cases and controls were geocoded by the GEOCIBLE Company (Saint-Maurice/France) using the geographic information system MAPINFO (New York/USA), the NAVTEQ (Paris/France) street databases and detailed vectorized maps from the National Geographic Institute (Saint-Mand /France).                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | The outcome data were obtained from the French NRCH.                                                                                                                                                                                                                                                                                   |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                        |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                       |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                        |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified<br>This study was supported by Institut de Veille Sanitaire (InVS), Agence Nationale de S curit  Sanitaire de l'Alimentation, de l'Environnement et du Travail (ANSES), Association pour la Recherche sur le Cancer (ARC), Fondation Pfizer, Institut National du Cancer (INCa), Agence Nationale de la Recherche (ANR). |

## (27) Bithell et al. 2013[43]

| Domains                                                                                         | Rating          | Comments                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low  | The study included cases in same period and region from the National Registry of Childhood Tumours (NRCT).                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>2. Confounding bias</b>                                                                      |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high   | Not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low  | The study excluded the Sellafield site based on the reasons given in the Committee on Medical Aspects of Radiation in the Environment 2011.                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low  | For over 90% of the cases and controls, the grid reference of the actual residential address at birth could be located using the Ordnance Survey product, ADDRESS-POINT; for the remainder, the postcode was used provided it determined the location to an accuracy equivalent at least to the approximate house number.<br>The authors defined proximity to a nuclear power plant as the reciprocal of the distance in kilometer from residential address at birth or diagnosis to the nearest of these plants commissioned before the case child was born. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low  | The cancers data were provided from the NRCT and were classified using the 3 <sup>rd</sup> version of the ICCC.                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>5. Selective reporting bias</b>                                                              |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low  | The outcome has been reported in OR and 95% CI.<br>The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>6. Other bias</b>                                                                            |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 6.1 Conflict of interest                                                                        | Definitely high | One of author carries out paid consultancy work, including work for the nuclear industry.                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |

(28) Lane et al. 2013[44]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                            |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the cancer incidence data from 1990 to 2008 for populations living within 25 km of three Ontario nuclear power plants for observed group and the general Ontario population for expected group, both of them were provided by the Ontario Cancer Registry (OCR) and the Canadian Cancer Registry (CCR). |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                            |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and sex. They did not adjust for other potential confounding factor.                                                                                                                                                                                                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                            |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                            |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors have clearly interpreted the measurement or estimation of dose calculations among the public living near Ontario nuclear power plants in study.                                                                                                                                                                |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The case data was collected from the OCR from 1990 to 1991 and the CCR from 1992 to 2008 and selected according to 3 <sup>rd</sup> version of the ICCC.                                                                                                                                                                    |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                            |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in SIR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                           |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                            |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                              |

## (29) Bollaerts et al. 2014[45]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                          |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                   |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the thyroid cancer incidence data in same period of the nuclear sites of interest.                                                                                                                             |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                   |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and sex. They did not adjust for other potential confounding factor.                                                                                                                                 |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                   |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                     |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                   |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | For each of the 589 Belgian communes, distances were calculated between the commune's centroid and the geographical location of the nuclear sites. The locations of the sites were determined by locating the nuclear facilities. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | Thyroid cancer incidence data according to the 10 <sup>th</sup> version of the ICD (C73 code) were requested from the Belgian Cancer Registry (BCR).                                                                              |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                   |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR, SIR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                              |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                   |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declared that no competing financial interests exist in study.                                                                                                                                                        |

(30) Wang et al. 2016[46]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                            |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study subjects included in the present study were inhabitant living in the eight townships interested. The Cancer Registry Database identified every patient by county and village of residence.                                                                                                                       |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                            |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | The authors adjusted for age and sex. They did not adjust for other potential confounding factor.                                                                                                                                                                                                                          |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                            |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                            |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The “plant-vicinity” group included inhabitants in the townships where nuclear power plants are located. The “non-plant-vicinity” group was chosen based on the New Taipei City General Development Plan and the Pingtung County Revised General Development Plan.                                                         |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The cancer data was collected from the Taiwan Cancer Registry Database compiled by the Health Promotion Administration, Ministry of Health and Welfare, which is coded using the International Classification of Diseases for Oncology (ICD-O), field trial edition for 1979–2001 and the ICD-O, third edition after 2002. |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                            |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                            |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                            |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare that they have no conflict of interest.                                                                                                                                                                                                                                                                |

(31) Khomenko et al. 2017[47]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included adults aged 18 years and over in Dnipropetrovsk region as observation zone, where the Zaporizhzhia nuclear power plant located, and Petrivsk district as controls zone in same period.                                                                                                                                                             |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                         |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                         |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The state statistical reporting data included into the form of the Ministry of Health of Ukraine no.12 «Report on the Diseases Registered in Patients Living in the Area Serviced by the Treatment and Prophylactic Establishment» were the information base for the analysis. The data were generalized by districts, Dnipropetrovsk region and overall, by Ukraine. |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The outcome data was classified by the 10 <sup>th</sup> version of the ICD.                                                                                                                                                                                                                                                                                           |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in morbidity rate. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                                                                                                      |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                                                                                                         |

(32) Demoury et al. 2017[48]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                 |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the data in the Flemish region from 2000 to 2014 and the Brussels-Capital region and the Walloon region from 2004 to 2014, which were selected from the Belgian Cancer Registry (BCR), a national population-based registry. |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                 |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Probably low   | The authors adjusted for age, sex, incidence year and region.                                                                                                                                                                                   |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                 |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                 |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors have clearly interpreted the measurement or estimation of surrogate exposure in study.                                                                                                                                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Probably low   | Thyroid cancer incidence data were selected from the BCR, a national population-based registry.                                                                                                                                                 |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                 |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                 |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                 |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare no conflict of interest.                                                                                                                                                                                                    |

## (33) Desbiolles et al. 2018[49]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                                                              |
|-------------------------------------------------------------------------------------------------|----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study was conducted around nuclear power plants at the level of the municipality, the smallest French administrative unit in rural areas and included adults aged $\geq 15$ years, who was diagnosed in the period of 1995 to 2011.                                               |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                                                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex, tobacco and alcohol consumption, deprivation, rural/urban status, population density, and exposure to pesticides, road traffic pollution, other polluting industries, benzene and high-voltage power lines.                                        |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                                                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Definitely low | Excluding any cancers for the Chooz nuclear power plant.                                                                                                                                                                                                                              |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                                                       |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The surrogate exposure measure was the distance between the nuclear power plant and the municipality's town hall. The municipalities were considered potentially exposed to nuclear power plants if they were within 20 km of plants; the area was called the "20-km proximity area". |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The outcome data was classified by the 3 <sup>rd</sup> version of the ICD-O.                                                                                                                                                                                                          |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                                                       |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                                                       |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                                                       |
| 6.1 Conflict of interest                                                                        | Probably high  | Not specified                                                                                                                                                                                                                                                                         |

## (34) Demoury et al. 2021[50]

| Domains                                                                                         | Rating         | Comments                                                                                                                                                                                                                                        |
|-------------------------------------------------------------------------------------------------|----------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Selection bias</b>                                                                        |                |                                                                                                                                                                                                                                                 |
| 1.1 Did selection of study participants result in appropriate comparison groups?                | Definitely low | The study included the case of children diagnosed with acute lymphoid or myeloid leukemia in the period of 2006 to 2016 and aged < 15 years at the time of diagnosis were included in the study, provided by the Belgian Cancer Registry (BCR). |
| <b>2. Confounding bias</b>                                                                      |                |                                                                                                                                                                                                                                                 |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? | Definitely low | The authors adjusted for age, sex, socio-economic index and median household income.                                                                                                                                                            |
| <b>3. Attrition/Exclusion bias</b>                                                              |                |                                                                                                                                                                                                                                                 |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                    | Probably high  | Not specified                                                                                                                                                                                                                                   |
| <b>4. Detection bias</b>                                                                        |                |                                                                                                                                                                                                                                                 |
| 4.1 Can we be confident in the exposure characterization?                                       | Definitely low | The authors have clearly interpreted the measurement or estimation of surrogate exposure in study.                                                                                                                                              |
| 4.2 Can we be confident in the outcome assessment?                                              | Definitely low | The case data was collected from the BCR, a national population-based registry, and selected according to the ICD-O-3 codes.                                                                                                                    |
| <b>5. Selective reporting bias</b>                                                              |                |                                                                                                                                                                                                                                                 |
| 5.1 Were all measured outcomes reported?                                                        | Definitely low | The outcome has been reported in RR and 95% CI. The outcome provided sufficient data, which could be included in meta-analysis.                                                                                                                 |
| <b>6. Other bias</b>                                                                            |                |                                                                                                                                                                                                                                                 |
| 6.1 Conflict of interest                                                                        | Definitely low | The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.                                                                      |

RR, relative risk; OR, odds ratio; SMR, standard mortality rate; SIR, standard incidence rate; ERR, excess relative risk; HR, hazard ratio; CR, crude ratio; ASR, age standardized ratio; CI, confidence interval.

**Table S10. Summary of the risk of bias of individual studies of workers in nuclear power plants according the NTP/OHAT risk of bias tool.**

| Domains                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Rating                |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|------------------------|--------------------------|------------------------|-------------------------|-----------------------|-----------------------|-------------------------|---------------------------|-------------------------|-----------------------|----------------------|-----------------------|
| <p>• Tier 1: A study must be rated as “definitely low” or “probably low” risk of bias for key elements and have most other applicable items answered “definitely low” or “probably low” risk of bias.</p> <p>Example of key risk of bias elements for observational human studies:</p> <ul style="list-style-type: none"> <li>o Can we be confident in the exposure characterization?</li> <li>o Can we be confident in the outcome assessment?</li> <li>o Does the study design or analysis account for important confounding variables?</li> </ul> <p>• Tier 2: Study meets neither the criteria for 1<sup>st</sup> or 3<sup>rd</sup> tiers.</p> <p>• Tier 3: A study must be rated as “definitely high” or “probably high” risk of bias for key elements and have most other applicable items answered “definitely high” or “probably high” risk of bias.</p> <p> <span style="background-color: #28a745; color: white; padding: 2px;">++</span> Definitely low risk of bias                <span style="background-color: #ffc107; color: black; padding: 2px;">+</span> Probably low risk of bias<br/> <span style="background-color: #dc3545; color: white; padding: 2px;">--</span> Definitely high risk of bias                <span style="background-color: #dc3545; color: white; padding: 2px;">-</span> Probably high risk of bias         </p> | Jablon et al. 1993[4] | Auvinen et al. 2002[5] | Zablotska et al. 2004[6] | Kindler et al. 2006[7] | Vrijheid et al. 2007[8] | Cardis et al. 2007[9] | Jeong et al. 2010[10] | Laurent et al. 2010[11] | Merzenich et al. 2014[12] | Azizova et al. 2018[13] | Boice et al. 2022[14] | Kudo et al. 2022[15] | Mumma et al. 2022[16] |
| <b>1. Selection bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 1.1 Did selection of study participants result in appropriate comparison groups?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ++                    | ++                     | ++                       | ++                     | ++                      | ++                    | ++                    | ++                      | ++                        | ++                      | ++                    | ++                   | ++                    |
| <b>2. Confounding bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? ( <b>key domain</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -                     | +                      | ++                       | ++                     | -                       | -                     | ++                    | ++                      | +                         | ++                      | -                     | +                    | +                     |
| <b>3. Attrition/Exclusion bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | -                     | ++                     | ++                       | -                      | ++                      | ++                    | ++                    | ++                      | ++                        | ++                      | ++                    | ++                   | ++                    |
| <b>4. Detection bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 4.1 Can we be confident in the exposure characterization? ( <b>key domain</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ++                    | ++                     | ++                       | +                      | +                       | +                     | ++                    | ++                      | ++                        | ++                      | ++                    | ++                   | ++                    |
| 4.2 Can we be confident in the outcome assessment? ( <b>key domain</b> )                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | +                     | +                      | ++                       | +                      | ++                      | +                     | ++                    | ++                      | ++                        | ++                      | ++                    | ++                   | ++                    |
| <b>5. Selective reporting bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 5.1 Were all measured outcomes reported?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ++                    | ++                     | ++                       | ++                     | ++                      | ++                    | ++                    | ++                      | ++                        | ++                      | ++                    | ++                   | ++                    |
| <b>6. Other bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |                        |                          |                        |                         |                       |                       |                         |                           |                         |                       |                      |                       |
| 6.1 Conflict of interest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -                     | -                      | -                        | -                      | ++                      | ++                    | -                     | -                       | -                         | -                       | ++                    | -                    | --                    |
| <b>Summary tier</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>T 2</b>            | <b>T 1</b>             | <b>T 1</b>               | <b>T 1</b>             | <b>T 2</b>              | <b>T 2</b>            | <b>T 1</b>            | <b>T 1</b>              | <b>T 1</b>                | <b>T 1</b>              | <b>T 2</b>            | <b>T 1</b>           | <b>T 1</b>            |

NTP/OHAT, National Toxicology Program/Office of Health Assessment Translation.

**Table S11. Summary of the risk of bias of individual studies of residents living near nuclear power plants according the NTP/OHAT risk of bias tool.**

| Domains                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Rating                  |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|-----------------------|------------------------|--------------------------|---------------------------|---------------------------|----------------------------|----------------------------|------------------------|------------------------------|------------------------------|----------------------------|-------------------------|------------------------------|---------------------------|-----------------------|-------------------------|
| <p>• Tier 1: A study must be rated as “definitely low” or “probably low” risk of bias for key elements and have most other applicable items answered “definitely low” or “probably low” risk of bias.</p> <p>Example of key risk of bias elements for observational human studies:</p> <ul style="list-style-type: none"> <li>o Can we be confident in the exposure characterization?</li> <li>o Can we be confident in the outcome assessment?</li> <li>o Does the study design or analysis account for important confounding variables?</li> </ul> <p>• Tier 2: Study meets neither the criteria for 1<sup>st</sup> or 3<sup>rd</sup> tiers.</p> <p>• Tier 3: A study must be rated as “definitely high” or “probably high” risk of bias for key elements and have most other applicable items answered “definitely high” or “probably high” risk of bias.</p> <div> <div>++ Definitely low risk of bias</div> <div>+- Probably low risk of bias</div> <div>-- Definitely high risk of bias</div> <div>- Probably high risk of bias</div> </div> | Enstrom et al. 1983[17] | Baron et al. 1984[18] | Ewings et al. 1989[19] | Urquhart et al. 1991[20] | Michaelis et al. 1992[21] | Goldsmith et al. 1992[22] | McLaughlin et al. 1993[23] | Hattchouel et al. 1995[24] | Morris et al. 1996[25] | López-Abente et al. 1999[26] | López-Abente et al. 2001[27] | Silva-Mato et al. 2003[28] | Mangano et al. 2003[29] | White-Koning et al. 2004[30] | Yoshimoto et al. 2004[31] | Boice et al. 2005[32] | Kaatsch et al. 2008[33] |
| <b>1. Selection bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 1.1 Did selection of study participants result in appropriate comparison groups?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ++                      | ++                    | ++                     | ++                       | ++                        | ++                        | ++                         | ++                         | ++                     | ++                           | ++                           | ++                         | ++                      | ++                           | ++                        | ++                    | ++                      |
| <b>2. Confounding bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | -                       | -                     | -                      | -                        | -                         | -                         | -                          | -                          | ++                     | +                            | +                            | -                          | -                       | +                            | -                         | -                     | -                       |
| <b>3. Attrition/Exclusion bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ++                      | -                     | -                      | ++                       | -                         | -                         | ++                         | -                          | ++                     | ++                           | -                            | -                          | -                       | -                            | ++                        | ++                    | -                       |
| <b>4. Detection bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 4.1 Can we be confident in the exposure characterization? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ++                      | ++                    | ++                     | ++                       | ++                        | ++                        | ++                         | ++                         | ++                     | ++                           | ++                           | ++                         | ++                      | ++                           | ++                        | ++                    | ++                      |
| 4.2 Can we be confident in the outcome assessment? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ++                      | ++                    | +                      | +                        | +                         | +                         | ++                         | ++                         | +                      | ++                           | ++                           | +                          | ++                      | +                            | ++                        | ++                    | +                       |
| <b>5. Selective reporting bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 5.1 Were all measured outcomes reported?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ++                      | ++                    | ++                     | ++                       | ++                        | ++                        | ++                         | ++                         | ++                     | ++                           | ++                           | ++                         | ++                      | ++                           | ++                        | ++                    | ++                      |
| <b>6. Other bias</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |                       |                        |                          |                           |                           |                            |                            |                        |                              |                              |                            |                         |                              |                           |                       |                         |
| 6.1 Conflict of interest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | -                       | -                     | -                      | -                        | -                         | -                         | -                          | -                          | -                      | -                            | -                            | -                          | -                       | -                            | -                         | -                     | ++                      |
| <b>Summary tier</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | T 2                     | T 2                   | T 2                    | T 2                      | T 2                       | T 2                       | T 2                        | T 2                        | T 1                    | T 1                          | T 1                          | T 2                        | T 2                     | T 1                          | T 2                       | T 2                   | T 2                     |

**Table S7. Continued.**

| Domains                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Rating                 |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|----------------------|-------------------------|----------------------------|-------------------------|--------------------|------------------------|---------------------|-------------------------------|-------------------------|----------------------|---------------------------|----------------------|--------------------------|-------------------------|----------------------------|-------------------------|
| <div><div>• Tier 1: A study must be rated as “definitely low” or “probably low” risk of bias for key elements and have most other applicable items answered “definitely low” or “probably low” risk of bias.</div><div>Example of key risk of bias elements for observational human studies:<div><div>o Can we be confident in the exposure characterization?</div><div>o Can we be confident in the outcome assessment?</div><div>o Does the study design or analysis account for important confounding variables?</div></div></div><div>• Tier 2: Study meets neither the criteria for 1<sup>st</sup> or 3<sup>rd</sup> tiers.</div><div>• Tier 3: A study must be rated as “definitely high” or “probably high” risk of bias for key elements and have most other applicable items answered “definitely high” or “probably high” risk of bias.</div><div><div><div>++</div>Definitely low risk of bias</div><div><div>+</div>Probably low risk of bias</div><div><div>--</div>Definitely high risk of bias</div><div><div>-</div>Probably high risk of bias</div></div></div> | Zadnik et al. 2008[34] | Spix et al. 2009[35] | Mangano et al. 2009[36] | Heinävaara et al. 2010[37] | Spycher et al. 2011[38] | Ma et al. 2011[39] | Bazyka et al. 2012[40] | Ahn et al. 2012[41] | Sermage-Faure et al. 2012[42] | Bithell et al. 2013[43] | Lane et al. 2013[44] | Bollaerts et al. 2014[45] | Wang et al. 2016[46] | Khomenko et al. 2017[47] | Demoury et al. 2017[48] | Desbiolles et al. 2018[49] | Demoury et al. 2021[50] |
| 1. Selection bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 1.1 Did selection of study participants result in appropriate comparison groups?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ++                     | ++                   | ++                      | ++                         | ++                      | ++                 | ++                     | ++                  | ++                            | ++                      | ++                   | ++                        | ++                   | ++                       | ++                      | ++                         | ++                      |
| 2. Confounding bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 2.1 Did the study design or analysis account for important confounding and modifying variables? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -                      | +                    | -                       | +                          | +                       | -                  | -                      | ++                  | +                             | -                       | -                    | -                         | -                    | -                        | +                       | ++                         | ++                      |
| 3. Attrition/Exclusion bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 3.1 Were outcome data complete without attrition or exclusion from analysis?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ++                     | ++                   | ++                      | ++                         | ++                      | -                  | ++                     | ++                  | ++                            | ++                      | -                    | -                         | -                    | -                        | -                       | ++                         | -                       |
| 4. Detection bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 4.1 Can we be confident in the exposure characterization? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ++                     | ++                   | ++                      | ++                         | ++                      | ++                 | ++                     | ++                  | ++                            | ++                      | ++                   | ++                        | ++                   | ++                       | ++                      | ++                         | ++                      |
| 4.2 Can we be confident in the outcome assessment? (key domain)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | +                      | +                    | +                       | ++                         | ++                      | ++                 | ++                     | ++                  | +                             | ++                      | ++                   | ++                        | ++                   | ++                       | +                       | ++                         | ++                      |
| 5. Selective reporting bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 5.1 Were all measured outcomes reported?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ++                     | ++                   | ++                      | ++                         | ++                      | ++                 | ++                     | ++                  | ++                            | ++                      | ++                   | ++                        | ++                   | ++                       | ++                      | ++                         | ++                      |
| 6. Other bias                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |                      |                         |                            |                         |                    |                        |                     |                               |                         |                      |                           |                      |                          |                         |                            |                         |
| 6.1 Conflict of interest                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | -                      | ++                   | -                       | ++                         | ++                      | -                  | -                      | -                   | -                             | --                      | -                    | ++                        | ++                   | -                        | ++                      | -                          | ++                      |
| Summary tier                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | T 2                    | T 1                  | T 2                     | T 1                        | T 1                     | T 2                | T 2                    | T 1                 | T 1                           | T 2                     | T 2                  | T 2                       | T 2                  | T 2                      | T 1                     | T 1                        | T 1                     |

NTP/OHAT, National Toxicology Program/Office of Health Assessment Translation.

## Appendix 8 Sensitivity analysis

**Table S12. Summary of sensitivity analysis of pooled estimates on meta-analysis random-effects model for all-cancer among workers in nuclear power plants.**

| Cause                      | Number of study groups | Pooled RR (95% CI) | Relative difference on average (%) (range) |
|----------------------------|------------------------|--------------------|--------------------------------------------|
| <b>Cancers</b>             |                        |                    |                                            |
| All-cancer                 | 20                     | 0.85 (0.75–0.97)   | 1.3% (0.1%–3.9%)                           |
| Brain and CNS cancer       | 6                      | 0.87 (0.75–1.02)   | 5.2% (0.2%–28.3%)                          |
| Colon cancer               | 7                      | 0.95 (0.86–1.06)   | 0.9% (0%–4.5%)                             |
| Esophageal cancer          | 2                      | 1.01 (0.34–3.03)   | 73.1% (32.8%–113.3%)                       |
| Leukemia                   | 9                      | 1.05 (0.91–1.21)   | 1.8% (0.1%–13%)                            |
| Liver cancer               | 4                      | 0.42 (0.17–1.00)   | 16.1% (0.3%–26.1%)                         |
| Lung cancer                | 16                     | 1.04 (0.85–1.27)   | 2.8% (0.2%–5.9%)                           |
| Mesothelioma               | 2                      | 5.53 (4.05–7.54)   | 5.4% (0.5%–10.4%)                          |
| Pancreatic cancer          | 7                      | 0.84 (0.50–1.42)   | 9.1% (1.5%–19.8%)                          |
| Prostate cancer            | 7                      | 0.45 (0.18–1.16)   | 29.6% (4.3%–116%)                          |
| Rectal cancer              | 6                      | 1.10 (0.59–2.08)   | 11.9% (6%–21.9%)                           |
| Stomach cancer             | 7                      | 0.99 (0.83–1.18)   | 1.5% (0.1%–6.4%)                           |
| Thyroid cancer             | 5                      | 2.29 (0.76–6.90)   | 26.4% (10.6%–38.3%)                        |
| <b>Non-cancer diseases</b> |                        |                    |                                            |
| Cerebrovascular disease    | 5                      | 0.92 (0.75–1.12)   | 5.5% (1%–10.8%)                            |
| Circulatory disease        | 6                      | 0.93 (0.78–1.11)   | 3.7% (0.7%–6.7%)                           |
| Digestive disease          | 3                      | 0.78 (0.39–1.59)   | 13.9% (0.8%–27.5%)                         |
| Respiratory disease        | 3                      | 0.05 (0.001–2.47)  | 596.1% (77.5%–1624.2%)                     |

CNS, central nervous system; mSv, millisievert; RR, relative risk; CI, confidence interval.

**Table S13. Summary of sensitivity analysis of pooled estimates on meta-analysis random-effects model for all-cancer among residents living within 30 km of the nuclear power plants.**

| Cause          | Number of study groups | Pooled RR (95% CI) | Relative difference on average (%) (range) |
|----------------|------------------------|--------------------|--------------------------------------------|
| All-cancer     | 53                     | 1.05 (1.00–1.09)   | 0.6% (0.0%–1.9%)                           |
| Breast cancer  | 19                     | 1.01 (0.93–1.10)   | 1.4% (0.1%–4.8%)                           |
| Leukemia       | 102                    | 1.09 (1.03–1.16)   | 0.2% (0.0%–1.2%)                           |
| Lung cancer    | 22                     | 0.96 (0.86–1.08)   | 1.2% (0.0%–4.3%)                           |
| Stomach cancer | 19                     | 0.99 (0.85–1.16)   | 1.7% (0.1%–6.4%)                           |
| Thyroid cancer | 27                     | 1.17 (1.04–1.32)   | 1.2% (0.0%–2.6%)                           |

CNS, central nervous system; mSv, millisievert; RR, relative risk; CI, confidence interval.

## Appendix 9 Comparison with previous meta-analysis

**Table S14. The comparison with previous meta-analyses.**

| Author                  | Present meta-analysis                                                                                                                                                                                                                                                                               | Baker et al. (2007)[52]                                         | Kim et al. (2016)[53]                                                                                                                                                                                                                                                                                                 | Qu et al. (2018)[54]                                                                                                                                                                                                                                           | Hauptmann et al. (2020)[55]                                                                                                                | Visci et al. (2022)[56]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Study population</b> | Workers in nuclear power plants<br><br>Residents living near nuclear power plants                                                                                                                                                                                                                   | Residents aged under 26 years living near nuclear installations | Residents living near nuclear power plants                                                                                                                                                                                                                                                                            | Workers in the nuclear industry with a main occupation in dose ionizing radiation (mean mining, refining, enrichment, non-destructive testing and nuclear weapon research, but not in nuclear power plants, medical facilities, education or nuclear accidents | Populations exposed to low-dose ionizing radiation (mean cumulative dose <100 mGy).                                                        | Workers in the nuclear industry<br><br>Patients exposed to either Thorotrast (a contrast agent used for x-rays) or the EBRT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Databases</b>        | Cochrane Library<br>PubMed<br>ScienceDirect<br>Web of Science                                                                                                                                                                                                                                       | Not specified                                                   | Medline<br>Embase                                                                                                                                                                                                                                                                                                     | PubMed<br>Embase                                                                                                                                                                                                                                               | Analyses included epidemiological studies published since the Biological Effects of Ionizing Radiation VII report in 2006 and before 2018. | PubMed<br>Scopus<br>Embase                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Keywords</b>         | “((“nuclear power plant” OR “nuclear site” OR “nuclear power” OR “nuclear facility” OR “nuclear industry” OR “nuclear installation”) NOT (accident OR disaster OR “nuclear power plant incident”)) AND ((resident OR worker) OR (epidemiology OR incidence OR mortality OR death rate OR illness))” | Not specified                                                   | “nuclear facility”, “nuclear sites”, “nuclear industry”, “nuclear power plants”, “nuclear installations”, “radiation exposure”, “ionizing cancer” OR “colorectal cancer” OR “stomach cancer” OR “colon cancer” OR “thyroid neoplasm”, “intestinal cancer” OR “rectum cancer”, “thyroid cancer” OR “thyroid carcinoma” | “nuclear ‘solid cancer’ OR ‘lung cancer’ OR ‘brain cancer’ OR ‘central nervous system cancer’ OR ‘stomach cancer’ OR ‘colon cancer’ OR ‘bladder cancer’ OR ‘prostate cancer’ AND ‘mortality’ AND ‘nuclear industry’ OR ‘nuclear facility’                      | Not specified                                                                                                                              | (Radiotherapy OR EBRT OR “external beam radiotherapy” OR “stereotactic radiotherapy” OR (peritoneal AND irradiation) OR radionuclides OR “therapeutic ionizing radiation”) OR ((Nuclear AND (industry * OR work OR worker * OR job)) OR (Radiation AND (industry * OR work OR worker * OR job)) OR “Radiography / adverse effects” [Mesh] OR (hiroshima [tiab] OR (nagasaki [tiab] OR atomic bomb survivors OR life span study) OR “Thorium Dioxide [Mesh] OR Thorotrast”).<br>AND<br>((“Etiology” [Subheading] OR etiologic * OR Neoplasm, Radiation-Induced [MH] OR Neoplasms, Radiation-Induced * OR Neoplasms, Second Primary [MH] OR Neoplasms, Second Primary * OR etiology [MH] OR aetiological * OR aetiology OR Cohort Studies [MH])) |

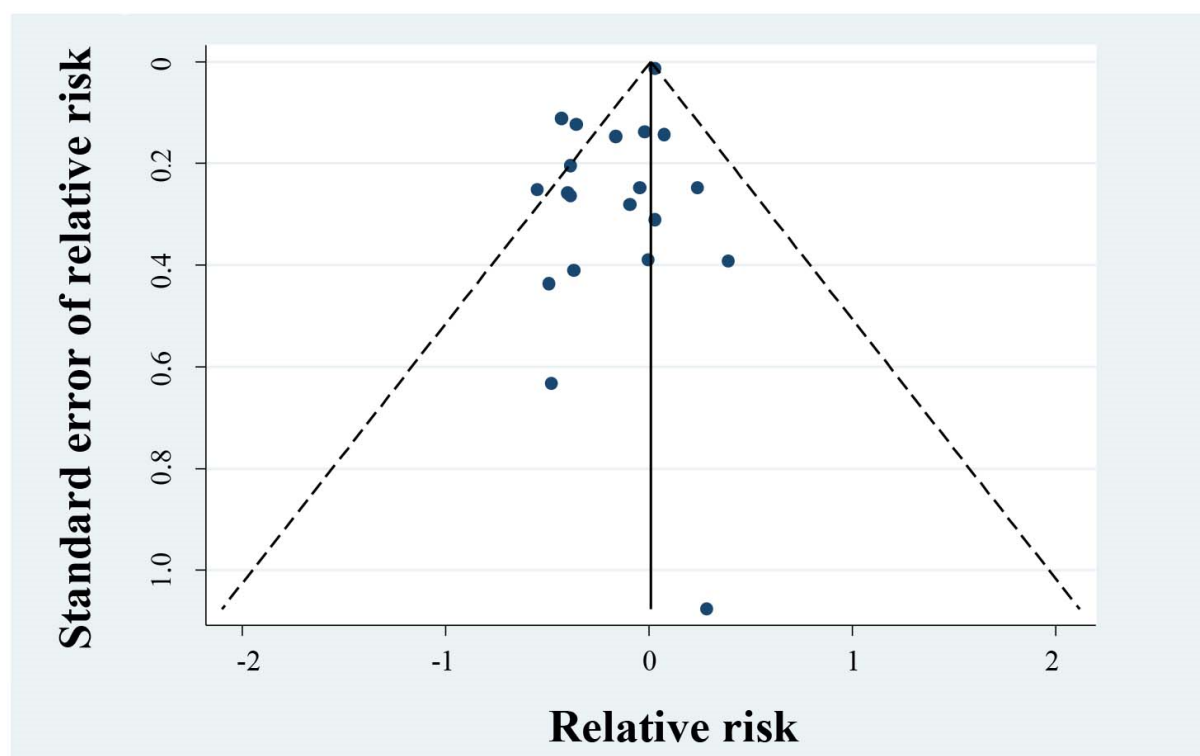
| Author                     | Present meta-analysis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Baker et al. (2007)[52]                                      | Kim et al. (2016)[53]                                       | Qu et al. (2018)[54]                                                                                                                               | Hauptmann et al. (2020)[55]                                            | Visci et al. (2022)[56]                                                                                                                                                                                     |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                              |                                                             |                                                                                                                                                    |                                                                        | AND<br>“Mesothelioma” OR “pleural cancer / neoplasm” OR “peritoneal cancer / neoplasm”                                                                                                                      |
| <b>Searching period</b>    | Before January 13, 2023                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Not specified                                                | Before March 2015                                           | Between January 1, 2000 and December 31, 2016                                                                                                      | Not specified                                                          | Before June 2021                                                                                                                                                                                            |
| <b>Guideline</b>           | PRISMA<br>Cochrane                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No                                                           | No                                                          | No                                                                                                                                                 | No                                                                     | PRISMA                                                                                                                                                                                                      |
| <b>Exposure definition</b> | Occupational whole-body ionizing radiation exposure<br><br>Distance or geographic location to the nuclear power plants                                                                                                                                                                                                                                                                                                                                                                                               | Distance or geographic location to the nuclear installations | Distance or geographic location to the nuclear power plants | Whole-body ionizing radiation exposure (with a cumulative radiation mean dose of <0.5 Sv/year, or at dose <100 mGy) a low dose rate [<10 mSv/day]) | Exposed to low-dose ionizing radiation (mean cumulative dose <100 mGy) | Therapeutic exposure: Thorotrast (a contrast agent used for x-rays) or the EBRT<br><br>Occupational exposure: Gamma ray, neutrons, uranium, plutonium, tritium, and other radionuclides in nuclear industry |
| <b>Exposure range</b>      | For workers:<br>5–200 mSv<br><br>For residents:<br>1.56–29 km (comparison areas: more than 30 km)                                                                                                                                                                                                                                                                                                                                                                                                                    | 0–16 km                                                      | 0–30 km (comparison areas: more than 30 km or 50–100 km)    | <0.5 Sv/year, or<br><10 mSv/day                                                                                                                    | Mean cumulative dose <100 mGy                                          | No                                                                                                                                                                                                          |
| <b>Outcome definition</b>  | For workers:<br>All-cancer, 12 kinds of cancers, as follows: brain and CNS cancer, colon cancer, esophageal cancer, leukemia, liver cancer, lung cancer, mesothelioma, pancreatic cancer, prostate cancer, rectal cancer, stomach cancer, thyroid cancer, and four kinds of non-cancer diseases, as follows: cerebrovascular disease, circulatory disease, digestive disease, and respiratory disease.<br><br>For residents:<br>All-cancer, five kinds of cancers, as follows: breast cancer, leukemia, lung cancer, | Leukemia                                                     | Thyroid cancer                                              | Nine kinds of cancers, as follows: cancers of the lung, brain and CNS, liver, stomach, colorectum, kidney, bladder and prostate.                   | All-malignant neoplasms                                                | Mesothelioma                                                                                                                                                                                                |

| Author                                       | Present meta-analysis                                                                                                                                                                                                                                                                                                                                                                                                  | Baker et al. (2007)[52]                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Kim et al. (2016)[53]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Qu et al. (2018)[54]                                                                                                                                                             | Hauptmann et al. (2020)[55]                                                                               | Visci et al. (2022)[56]                                                                                                                           |
|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
|                                              | stomach cancer, and thyroid cancer.                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                  |                                                                                                           |                                                                                                                                                   |
| <b>Exclusion criteria</b>                    | 1. The studies did not focus on occupational or environmental exposure to nuclear power plants in normal operation.<br>2. The studies with overlapping populations, we selected the study with the longest study period.<br>3. The studies no effect measures or sufficient data.<br>4. The studies focused on inheritance, genetics, or cell biology.<br>5. The studies of reviews, letters, or conference abstracts. | 1. Restricted in cohort studies.<br>2. The study did not include at least two of the following three variables: observed, expected, or end point (SIR or SMR) for individual nuclear sites, as opposed to a summarization that includes multiple sites.<br>3. The study did not have at least one age category less than 26 (only ages less than 26 were used in the meta-analysis).<br>4. The study did not indicate geographical zones in which cases or deaths occurred. | 1. Studies that reported results from the Chernobyl or Fukushima accidents, fallout, any accident from unusual operation, or nuclear weapons testing sites were excluded.<br>2. If there was more than one article with the same or overlapping population, preference was given to the article providing more comprehensive, updated information.<br>3. If the article type was a review, letter, or comments, the study was excluded.<br>4. The studies that did not provide quantitative effect estimates about thyroid cancer. | Data were excluded for all reviews, books and reports where workers were engaged in their activities for <1 year, and from all articles containing insufficient/incomplete data. | 1. Studies with the hypothesis that the median ERR equals zero<br>2. Studies with potential positive bias | 1. Studies with wrong outcome<br>2. Studies with wrong exposure<br>3. Studies of reviews and case report<br>4. Studies with lack of risk measures |
| <b>Types of included studies</b>             | Cohort study, case-control study, and ecologic study                                                                                                                                                                                                                                                                                                                                                                   | Cohort study                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Cohort study                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Cohort study                                                                                                                                                                     | Cohort study                                                                                              | Cohort study and case-control study                                                                                                               |
| <b>Quality assessment</b>                    | NTP/OHAT                                                                                                                                                                                                                                                                                                                                                                                                               | No                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | MOOSE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No                                                                                                                                                                               | No                                                                                                        | A checklist drawn up on the basis of the NIH indications was used.                                                                                |
| <b>Number of included studies</b>            | 47 studies (13 on workers; 34 on residents)                                                                                                                                                                                                                                                                                                                                                                            | 17 studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 13 studies                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 27 studies                                                                                                                                                                       | 26 studies (eight for environmental, four for medical, and 14 for occupational exposure)                  | Nine studies (four on radiation therapy; five on nuclear worker)                                                                                  |
| <b>Publication years of included studies</b> | For workers:<br>1993–2022<br><br>For residents:<br>1983–2021                                                                                                                                                                                                                                                                                                                                                           | 1984–1999                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1993–2014                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2000–2016                                                                                                                                                                        | 2006–2017                                                                                                 | For workers:<br>1998–2016<br><br>For radiation therapy:<br>2002–2017                                                                              |
| <b>Study period of included studies</b>      | For workers:<br>1947–2011                                                                                                                                                                                                                                                                                                                                                                                              | 1950–1993                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1950–2010                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1942–2008                                                                                                                                                                        | 1948–2012                                                                                                 | For workers:<br>1946–2015                                                                                                                         |

| Author                                | Present meta-analysis                                                                                                                                                                                                                                                                                                                                                            | Baker et al. (2007)[52]                     | Kim et al. (2016)[53]                                                   | Qu et al. (2018)[54]                     | Hauptmann et al. (2020)[55]              | Visci et al. (2022)[56]                |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------|------------------------------------------|------------------------------------------|----------------------------------------|
|                                       | For residents:<br>1959–2016                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                         |                                          |                                          | For radiation therapy:<br>1965–2014    |
| <b>Population of included studies</b> | 480,623 workers and 7,530,886 residents                                                                                                                                                                                                                                                                                                                                          | Not specified                               | 2,298 cases                                                             | 667,729 workers                          | Not specified                            | 285,689 workers and 1,276,774 patients |
| <b>Statistical analysis</b>           | Random-effect models<br>Meta-regression                                                                                                                                                                                                                                                                                                                                          | Fixed-effect models<br>Random-effect models | Random-effect models                                                    | Random-effect models                     | Meta-ERR estimation                      | Random-effect models                   |
| <b>Subgroup analysis</b>              | For workers:<br>◦ Geographic area<br>◦ Average annual cumulative dose of radiation exposure<br>◦ Definition of comparators<br>◦ Age at the end of follow-up<br>◦ Risk of bias<br><br>For residents:<br>◦ Geographic area<br>◦ Age of study population<br>◦ Sex<br>◦ Study types<br>◦ Definition of exposure indicators<br>◦ Distance from nuclear power plants<br>◦ Risk of bias | ◦ Age<br>◦ Geographic zone                  | ◦ Region<br>◦ Gender<br>◦ Exposure definition<br>◦ Reference population | Not performed                            | Not performed                            | Not performed                          |
| <b>Test of heterogeneity</b>          | I-squared statistics                                                                                                                                                                                                                                                                                                                                                             | Chi-square tests                            | Chi-square tests<br>I-squared statistics                                | Chi-square tests<br>I-squared statistics | Chi-square tests<br>I-squared statistics | I-squared statistics                   |
| <b>Sensitivity analysis</b>           | Yes                                                                                                                                                                                                                                                                                                                                                                              | No                                          | Yes                                                                     | Yes                                      | No                                       | No                                     |
| <b>Publication bias</b>               | Egger's tests<br>Funnel plots                                                                                                                                                                                                                                                                                                                                                    | Funnel plots                                | Begg's and Egger's tests<br>Funnel plots                                | Begg's and Egger's tests<br>Funnel plots | No                                       | Egger's tests<br>Funnel plots          |
| <b>The certainty of evidence</b>      | GRADE                                                                                                                                                                                                                                                                                                                                                                            | No                                          | No                                                                      | No                                       | No                                       | No                                     |

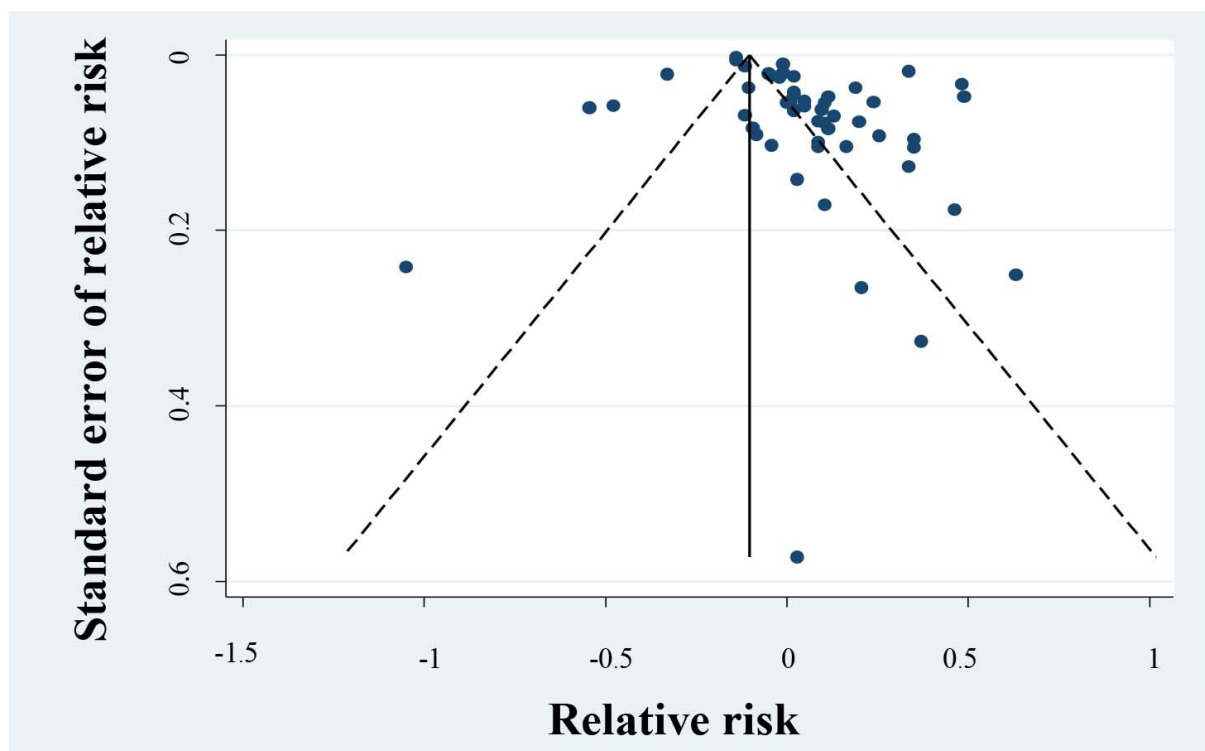
EBRT, external beam radiation therapy; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses; Sv, sievert; mSv/day, millisievert per year; km, kilometer; mSv/year, millisievert per year; mGy, milligray; CNS, central nervous system; SIR, standardized incidence rate; SMR, standardized mortality rate; ERR, excess relative risk; NTP/OHAT, National Toxicology Program/Office of Health Assessment Translation; MOOSE, Meta-analysis Of Observational Studies in Epidemiology; NIH, National Institutes of Health; GRADE, Grading of Recommendations Assessment, Development, and Evaluation

## Appendix 10 Funnel plot



**Figure S5. Funnel plot of publication bias of individual studies for all-cancer among workers in nuclear power plants (n = 20).**

n, number of study groups included in meta-analysis.



**Figure S6. Funnel plot of publication bias of individual studies for all-cancer among residents living within 30 km of nuclear power plants (n = 53).**

n, number of study groups included in meta-analysis.

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