

LETTER TO THE EDITOR FRENCH NUCLEAR POWER PLANTS AND CHILDHOOD LEUKEMIA

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The Geocap Study described by Sermage-Faure *et al.* (2012) suggested to them “*a possible excess risk of AL [childhood acute leukemia] in the close vicinity of French NPPs [nuclear power plants] in 2002-2007*”. The abstract contains general results of two analyses: the nationwide Geocap case-control study showing the odds ratio of cancer incidence $OR = 1.9$ (1.0–3.3, 95% confidence interval [CI]) and a concomitant study with standardized incidence ratio (SIR) = 1.9 (1.0–3.2, 95% CI). However, we provide evidence that this hypothetical risk increase is likely a statistical fluctuation. In addition, the data are subject to confounding factors that were not addressed. The putative increase in leukemia risk therefore cannot be justifiably attributed to very small radiation doses associated with the operation of the NPPs.

First, the authors have not one datum in Table 2 (Sermage-Faure *et al.* 2012) that shows a statistically significant increase in cancer risk, whether for children under 5 or under 15 years of age, in either the interval 1990-2001 or 2002-2007. Only by data dredging and subdividing the numbers into smaller time intervals and other discriminatory indices in Table 4 (Sermage-Faure *et al.* 2012), can they produce a few showing statistical significance. But then, the numbers of children included in each time interval are small.

Second, the results in the abstract are based on only 14 cancer cases near 19 NPPs. Fourteen cases are too few for a clinically significant result. Fourteen cases near 19 NPPs are on average 0.7 cases per NPP.

Third, neither any confounding factor nor individual history of the children (especially their migrations) was taken into consideration. These omissions and the mentioned small-sample-size-related statistical problems invalidate the claimed association of cancer risk with NPP proximity.

Additional weak points of the analysis were diligently mentioned by the authors (Sermage-Faure *et al.* 2012). First, no correlation was found between cancer cases and radioactive releases from NPPs. Second, similar French investigations several years earlier failed to find an increase in risk (White-Koning *et al.* 2004; Evrard *et al.* 2006; Laurier *et al.* 2008). And the evaluation over a wider time period (1990-2007) did not show a statistically significant risk increase. Third, total accumulated doses over the time period 2002-2007 were in the range of microsieverts – several orders of magnitude lower than the variations in natural background radiation. Fourth, lower doses were received by children living up to 5 km from the NPP, where the risk was estimated to be higher, while no risk increase was found among children who received the highest doses. These four weaknesses alone should have been sufficient to invalidate any claimed association between NPP operation and cancer, without the three points raised in this Letter. One can add also that despite the authors’ reluctance to unambiguously relate the leukemia incidence to the NPP emissions, they nevertheless suggest that leukemia is a consequence of radiation

exposure from NPP operation. We point out in the present Letter why this suggestion is not justified.

Attribution of an excess risk of cancers to nearby NPPs is a well known practice, even though many independent studies, such as COMARE (2011), CANUPIS (Spycher *et al.* 2011) or RADICON (2013), have demonstrated no correlation between radiation exposures around NPPs and cancer incidence. Observed increases can be attributed to population mixing, as pointed out in the most recent extensive review of childhood leukemia around NPPs (Janiak 2014). The population mixing hypothesis considered involves “*the influx of outside workers to rural regions where nuclear installations are being set up and where local people are not immune to pathogens brought along with the incomers*” (Janiak 2014).

The Geocap Study (Sermage-Faure *et al.* 2012) is one of many studies on cancer risk around NPPs. The presented conclusions implicitly blame NPP-related, low-dose-radiation exposures for increased cancer risk. The “*call for investigation for potential risk factors related to the vicinity of NPP*” (Sermage-Faure *et al.* 2012) should be seriously questioned because such studies will lack statistical power for demonstrating any change (increase or decrease) in risk. In addition, such studies can promote potentially-harmful radiophobia (Jaworowski 2010; Scott 2011; Orient 2014), thereby making it difficult to communicate accurate information to the public on the health effects of radiation exposure, especially in the event of an actual radiological emergency (Allison 2009; Sanders 2010).

The previous version of this Letter was submitted to the International Journal of Cancer. In his reply, the Editor stated that our remarks would not interest the journal’s readers.

Note: All signers of this letter are members or associate members of SARI (Scientists for Accurate Radiation Information, <http://radiationeffects.org/>). The above letter represents the professional opinions of the signers, and does not necessarily represent the views of their affiliated institutions.

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