The Risk of Childhood Leukaemia in the Vicinity of Nuclear Installations: a review

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Since the early years of the peaceful use of atomic energy there has been a debate on possible adverse health effects due the radioactive discharges from the reactors. While this discussion was focussed on infant mortality in the 1960s (1), it is since the 1980s mainly based on findings of increased numbers of leukaemia cases. In 1984 there was the famous report on a ten-fold increase in leukaemia mortality among young people close to the Sellafield reprocessing plant (2). Further local excesses were reported such as from the second British reprocessing plant Dounreay in Scotland (3) and from the German nuclear power station Kruemmel (4, 5). Each of these reports led to a number of further investigations to find possible explanations. Partly based on these investigations, the hypothesis of population mixing as a cause of an increased leukaemia risk was developed by Kinlen (6). Next to these local studies, larger multi-site studies were launched in several countries, e.g. UK, France and Germany. The population under study were mostly children at ages below 15 years. The multi-site studies revealed no elevated leukaemia risk among all children (see (7)). Still, some studies showed that there might be an elevated risk for the youngest age group (0-4 years) in the closest vicinity of the sites (about up to 5 km). All the multi-site studies were ecological studies which compared the mortality or incidence rates in certain areas around the nuclear sites. Until recently and except one study conducted in relation to the excess cases found near the Sellafield site (8), there were no case-control studies or cohort studies looking into a relationship between living close to a nuclear site and the risk of leukaemia among children. Early 2008, a case-control study from Germany, which looked at 16 nuclear sites with overall 22 power stations, reported a trend for an increasing leukaemia risk among 0-4 years old children with decreasing distance of place of residence to the sites (9). This trend could be detected even when not taking the cases near the Kruemmel site into consideration. Within the 5-km circle around the sites, the leukaemia risk was roughly twofold increased. As already mentioned, taking all internationally available ecological studies together, there is no hint for an increased leukaemia risk in the vicinity of nuclear installations for all children below the age of 15 (7). Thus, an elevated risk amongst the 0-4 years old would imply a lower risk amongst the 5-14 years old. That is exactly what can be seen based on German data (10). A recent re-analysis of extended data from Great Britain, which was first reported by COMARE (11), showed no increased risk for all children, but a higher risk for 0-4 years old than for those being 5-14 years of age. This risk was - although not statistically significant - highest within the 5-km-circle (12). For France, no elevated risks were found close to nuclear installations (13). Still, the values for the relative risks - though lower than expected - are higher amongst the 0-4 years old than they are for the

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other children. A highly speculative assumption is that a - yet undefined - agent causes by gene-environment interaction an earlier onset of the disease close to the sites amongst vulnerable children (14). If so, this would explain the absence of additional cases among children of all ages. Based on current knowledge on radiation risk, the radiation exposure to the public has to be considered as being too low by a factor of at least 1,000 to explain the observed effect described in the German study (9). But is has to be kept in mind that little is known about radiation effects from antenatal exposures or those during infancy on the leukaemia risk for ages up to 4 years.

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