

The mortality rate of male amateur radio operators in Western U.S. (California and Washington) was compared to that of the U.S. general population [Milham, 1988]. Exposure to stronger RF field was presumed for the amateur radio operators from their involvement in maintenance, repair and operation of radio equipment. Increased mortality was reported for certain cancers. For example, higher mortality ratios were shown for brain tumor (1.4), acute myeloid leukemia (1.8), and cancer in some lymphatic tissues (1.6). The potentially significant confounding factor of soldering fumes within this hobby group presents some uncertainty in using the outcome for risk analysis.

The two studies involving children living in close proximity to either microwave or radio tower used distance from the tower as a surrogate for exposure measure. In a cohort of 50,000, it was found that the relative risks of children (<21 years) for brain tumor, leukemia, Hodgkin's disease, and non-Hodgkin's lymphoma were not elevated if they lived within 3.5 km of a microwave tower in San Francisco [Selvin et al., 1992]. The other was a small case-control study based on a leukemia cluster around a broadcasting tower in Hawaii. A relative risk of 2.1 was associated with living within 4.2 km from the radio tower [Maskarinec and Cooper, 1993]. A number of potentially confounding factors were suggested but not explored by the authors.

The relation between RF exposure and brain tumor risk of males serving in the U.S. Air Force between 1970-1989 was the subject of a case-control study [Grayson, 1996]. A small increase in the RF, age, race, senior military rank-adjusted odds ratio (OR = 1.39) was detected. The finding is especially interesting in view of the negative result observed for a relatively well-characterized carcinogen such as ionizing radiation. Exposure of the men to ionizing radiation was reported to have an age, race, senior rank-adjusted OR of only 0.58. The association between RF exposure and brain tumor risk is weakened by small numbers (230 cases) and lack of exposure assessment. It is also confounded by the finding that senior military rank is the factor most strongly associated with excess brain tumor in this study. Senior Air Force officers were at increased risk (OR = 3.30) compared with all other Air Force population.

A surveillance to investigate the near-term mortality rates of portable cellular telephone users who were active during 1994 and had cellular telephone accounts that were at least three years old did not show an excess when compared to those using mobile telephones [Rothman et al., 1996]. A portable cellular telephone is defined as a cellular telephone in which the antenna is part of the handset. The assumption is that a portable telephone exposes the head of a user to radio frequency radiation transmitted from the antenna. Since the use of wireless cellular telephone is a very recent event and a large increase in mortality rate over the short term is a rare phenomenon, a significant difference cannot be expected from this preliminary study.

To summarize the recent epidemiological reports described above and in **Table 13**, two of the studies showed no excess cancer mortality and three studies gave excess relative risks that ranged from 1.4-2.1. Among the latter, the finding by Grayson [1996] was diluted by a small sample size. The highest risk ratio 2.1. was associated with a small cluster [Maskarinec and Cooper, 1993]. The study by Milham [1988] had soldering fumes as a confounding factor within the group. All of the above studies suffered from a lack of realistic measures of RF or microwave exposure. These considerations present profound uncertainties in their use for risk analysis. In addition, the two older studies summarized in **Table 12** also did not uncover a