Epidemiology and Human Studies

In recent years, there has been increasing attention on cancer induction and promotion by electromagnetic energy across a wide range of frequency bands. Epidemiology with its unique approach toward studying the incidence and distribution of disease offers a valuable investigative tool to assess the potential association between cancer and exposure to electromagnetic energy in the nonionizing spectrum. Prior to 1980, however, most epidemiological studies or medical surveillances in occupational settings did not take cancer induction into account (See [Silverman, 1980] and **Table 12**). Indeed, there were only two epidemiological papers reporting systematic evaluation of cancer and RF exposure [Lilienfield et al., 1978; Robinette et al., 1980]. **Table 13** summarizes five epidemiological investigations using cancer and mortality as the study endpoint during the past decade.

For many years, cataract induction has been the most often inculpated hazards of human exposure to microwave radiation. As mentioned previously the fact that cataracts can be induced in the eye of laboratory animals following prolonged exposure to intense microwave radiation is well-established. A cataractogenic power density- or SAR-duration threshold exists for which no cataract in laboratory animals may be expected no matter how long the duration for single, acute exposure.

Although there are case reports of cataracts in humans following accidental exposure to microwave radiation [Hirsch and Parker, 1952] and clinical reports suggesting that posterior capsule changes in the lens were more prominent in microwave workers than in controls [Zaret, 1974], only a small number of epidemiological studies of cataracts in humans have appeared in the literature (See **Table 12**). A case-control study of World War II and Korean War veterans in the U.S., based on military service and hospital admission records, found the frequencies of cataract formation were similar for radar and non-radar personnel [Cleary et al., 1965]. A statistically significant difference in lenticular changes between microwave exposed and the control group was observed in another study [Cleary and Pasternack, 1966]. Moreover, an apparent, age-related increase in lens change had made the authors to postulate that military-type, occupational exposure to microwave radiation may be implicated as a stress that increases the rate of lens aging. In the two related studies by Appleton et al. [Appleton and McCrossen, 1972; Appleton et al., 1975] selected military personnel were subjected to ophthalmologic examination and compared to other military personnel whose exposure history was deemed unlikely. They concluded that there was no association between military microwave operation and cataract or lens opacification. It is interesting to note that older age groups showed a trend toward lens opacities among exposed personnel. However, since the numbers in some age groups were small, a reasonable inference cannot be made.

Another recurrently expressed concern in the past is the effect of microwave exposure on growth and development. An increased history of paternal exposure to microwave radiation either as military radar technician or operator was reported to have a borderline statistically significant association with offspring with Down's syndrome Sigler et al., 1965]. However, an