

HEALTH SURVEILLANCE OF PERSONNEL PROFESSIONALLY EXPOSED TO MICROWAVES

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The biologic effects of microwaves are a highly controversial subject, certain authors/1/ admit only the possibility of thermal injury or overload, others/2/ describe adverse effects of long term low dose exposure, especially in central nervous system/3/ and hematopoietic functions/4/. The mechanism of these effects is poorly understood, nevertheless to discount such empirical observations simply because no adequate theoretical explanation is forthcoming seems to be an unsafe attitude of mind. In view of the many uncertainties practical guidelines for evaluation of health hazards and rules for health surveillance of personnel exposed professionally to microwaves must be considered a temporary solution. Such an empirical solution is proposed here with the double aim: to protect the health of the personnel in question and to form a satisfactory basis for the evaluation of the magnitude of the health hazards involved. Adequate health surveillance should in our opinion cover the following points:

1. evaluation of professional health risks.

The present unsatisfactory status of microwaves dosimetry/5/ does not permit precise individual monitoring. The exposed personnel may be only divided into groups, according to probable/estimated/ exposure. In the case of radiating equipment it is useful to distinguish between intended radiation /eg. radar beams/ which may be measured and according to the results safe or danger zones outlined and marked, at least in open space. Such equipment may

be also the source of incidental /non-intended/ radiation eg. power leaks. The personnel concerned may be classified as: a/group concerned in exploitation /E/ exposed only to intended radiation in open space or adequately screened rooms; it is possible to keep the exposure of such personnel below 10 or at the worst 100 $\mu\text{W}/\text{cm}^2$ /all power density values should be considered as indicative of orders of magnitude/; b/group concerned in exploitation in special conditions /ES/ eg working with radiating equipment in closed space/reflections and interference make the evaluation of exposure difficult/ and workers from assembly and production lines; c/group technical maintenance /R/ which comprises also certain categories of factory workers, constructors and laboratory personnel; as a rule this group is exposed not only to intended but also to incidental, uncontrolled /non-intended/ radiation. The exposure in group ES may be usually limited to $1 \text{ mW}/\text{cm}^2$ but for short periods and in rare instances it may be as high as $10 \text{ mW}/\text{cm}^2$. A similar exposure may be expected in group R augmented by the uncontrolled factor of non-intended radiation. This classification permits to evaluate the correlation between exposure and the clinical picture without any attempts at false accuracy. Other factors to be considered are - possible exposure to soft ionizing radiation, noise level, ambient temperature, lighting conditions/important for visual fatigue in radar operators/,

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ergonomical conditions/stress imposed by certain man-machine systems/.If the influence of these factors is excluded abnormal findings may be attributed to microwave irradiation.

2. Medical examinations before accepting a candidate for work or professional schooling comprise medical history with special attention to any trauma to the head, family history, sex life, addictions/alcohol, smoking/, sociologic background; physical general examination and ECG, neurologic examination and EEG ophthalmologic examination with special attention to any lens imperfections, laboratory examination/peripheral blood, ESR, urinalysis, chest X-ray/. Only persons with normal findings are accepted, individuals evaluated as neurotic or with signs of vegetative neurosis being excluded. A routine check up is made each year, more detailed /similar to the "initial"/periodic examination being made each three years. The findings are recorded in a personal health chart.

3. Evaluation of results poses very difficult problems in individual cases. Group results are correlated with working conditions and duration of work. Not all persons surveyed have undergone initial examinations, a part works for over 10 years i.e. before this system was introduced. In such cases groups working for the same periods of time under different exposure conditions are compared.

The results of our observations may be summarized shortly as follows:
group E does not show any abnormal

findings, which can be attributed to microwave irradiation. During the first year of work subjective complaints/head-aches, abnormal fatigue, sleepiness/are frequent, later disappear. Group ES is characterised by a very high percent of such complaints and after a period of over 5 years of work up to 50% are diagnosed as exhibiting symptoms of vegetative neurosis. 29% exhibit slight changes in peripheral blood /leucocytosis and tendency to anemia/. Group R is the only group with statistically significant objective findings, expressed by changes in EEG/borderline of normal/, presence of lens opacities not influencing visual acuity, hypotonia and bradycardia, changes in peripheral blood /leucopenia or leucocytosis, slight anemia/. In these cases work in lower exposure conditions is recommended. In about 0,3% of cases farther contact with microwaves was prohibited on medical grounds. The detailed analysis shows that in group R signs of prepathology appear after 5 years of work, statistically significant numbers of pathologic cases were not observed.

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