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EFFECTIVENESS OF PROTECTION AGAINST SW AND USW ELECTROMAGNETIC FIELDS AT RADIO AND TV STATIONS

(Effektivnost' zashchitnykh meropriyatii ot vozdeistviya elektromagnitnykh polei korotkikh i ul'trakorotkikh voln (KV i UKV) na radio-i televiziomnykh stantsiyakh)

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Studies of working conditions at radio and TV stations demonstrated the possibility of their servicing personnel being affected by the electromagnetic fields of short and ultrashort waves (Fukalova). Sources of SW and USW at radio and TV stations are in the transmitter blocks, in modulation units and separation filters, unshielded transmission lines (feeders) and radiating antenna systems.

Measurement of field intensities with an INP-LIOT instrument before the implementation of protective measures established intensities varying between 8 and 450 V/m, depending on the shielding of the sources and their location with respect to the working zones. In 1964 the Institute of Occupational Health of the Academy of Medical Sciences of the USSR recommended maximum permissible irradiations of 20 V/m and 5 V/m in the SW and USW ranges, respectively. These standards formed the basis for the development of protective measures. The protection of workers against the effects of electromagnetic waves at radio and TV stations may be ensured in two ways, depending on the type and number of SW and USW transmitters, nature of the commutation of electromagnetic energy to the antenna, and numbers of control instruments to be kept under observation. The first method calls for a direct reduction of electromagnetic energy at every radiation source by shielding the feeders or their replacement with coaxial cables, shielding of the glazed viewing windows and shutters, and elimination of cracks and leaks in modulation units and separation filters. The second method calls for centralized control and operation of transmitters in a shielded room.

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Efficiency of protection of workers against the effects of electromagnetic fields at radio and TV stations

Transmitters	Method of protection	Site of measurement	Field intensity, V/m		Remarks
			before shielding	after shielding	
SW (radio station)	Complete shielding of feeders and transmitters (first method)	At the output cascades At the preliminary cascades At the feeders At the control panel	150 - 250 80 - 120 90 - 200 40 - 80	10 - 26 6 - 12 7 - 14 6 - 10	
SW (radio station)	Shielding of feeders on the premises, but unshielded feeders outside the premises (first method)	At the output cascades At the preliminary cascades At the feeders At the control panel	60 - 82 20 - 32 150 - 200 7 - 20	20 - 30 16 - 20 60 - 95 5 - 16	
SW and USW (radio station)	Shielded section of feeder at the output of a powerful cascade of USW transmitter, unshielded feeders of other transmitters (first method)	At the output cascade of the USW transmitter At the preliminary cascade At the control panel	50 - 84 30 - 62 18 - 22	12 - 17 5 - 11 2 - 4	With other transmitters working, the field intensity increases to 50 - 110 V/m
USW (TV station)	Centralized operation of transmitters. The control panel and the control instruments are transferred to a shielded room (second method)	At the output cascades At the preliminary cascades At the control panel	150 - 220 30 - 82 19 - 22	Below the sensitivity of measuring instruments	

In the presence of a large number of transmitting and control units at the radio stations, the first method is the easier one to apply. In this case, an effective protection necessitates the complete shielding of all radiation sources in the working premises. Suitable shielding materials are sheets or screens of metals with high electrical conductivity and magnetic permeability (aluminum, copper, brass).

In the presence of a large number of radio units at the TV and radio stations, the second method can be used. In this case, the control panel and the pertaining control instruments are isolated in a shielded room (I. Ya. Yasinovskii). The walls, ceiling and floor of this room are covered with copper sheet (under the plaster and the parquet floor). The viewing windows (for the visual observation of transmitters) are protected with a metal screen. Normal climatic conditions are ensured by a general exchange ventilation according to hygienic standards SN-245-63.

Results obtained in testing the effectiveness of these methods in the protection of workers against SW and USW electromagnetic fields are shown in the table. It follows from the table that the field intensities were considerably reduced by the complete screening of the feeders and transmitters in the working premises (7 to 26 V/m).

Incomplete screening of the radiation sources yields only an insignificant reduction in the field intensities. For instance, the shielding of feeders in the transmitter hall only does not ensure sufficient protection for the workers against electromagnetic fields, because the latter are capable of penetrating the hall from the outside portions of nonshielded feeders.

Shielding of individual transmitters and their feeders resulted in a reduction of field intensities to 2—17 V/m. In the case of simultaneous operation of nonshielded transmitters there was a considerable increase in the intensities in the transmitter hall (tens and hundreds of volt-meters).

Consequently, the shielding of individual sources does not ensure a reduction in the field intensities down to the recommended maximum permissible intensities unless measures are taken to reduce energy radiated by all the sources. The table likewise shows that the residual field intensity may be reduced below the sensitivity of measurements by the second method of protection, which is a testimony of its effectiveness.

Thus, the seond method of protection is preferable from the viewpoint of protecting the workers against the effects of SW and USW electromagnetic fields. The use of the first method is not capable of reducing the field intensities to recommended permissible levels unless shielding is applied to all sources irradiating electromagnetic energy into the working premises.