# THE EXPERIMENTAL INVESTIGATIONS OF LOW FREQUENCY NOISES IN THE EVERYDAY ENVIRONMENT OF MAN

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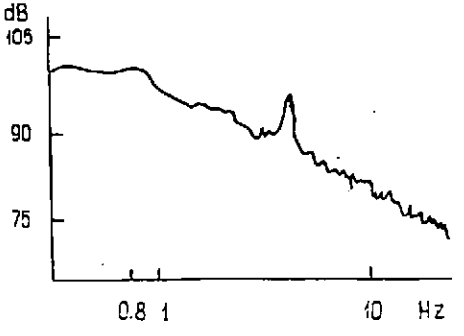
It is known that the human ear practically perceive the sound waves with the frequency below 20 Hz. These sound waves are called infrasound noise or infrasound. But there is a significant number of the scientific works in which it is stated that low frequency noises still have an influence on a man and this influence is not always might be considered as a positive one [1,2]. The purpose of this work is a preliminary analysis of the infrasound behavior forming the everyday environment of the man.

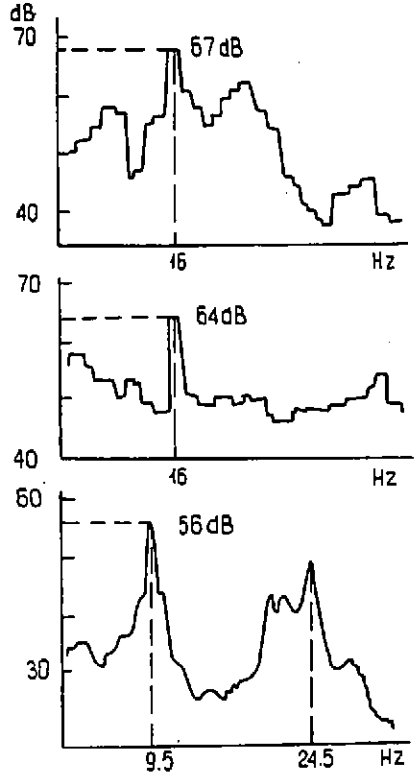
Atmospheric infrasound noises coming from natural sources followed the mankind from its birth.

During the scientific-research cruise in 1990 we observed the low frequency level in the atmosphere over aquatorium of the Pacific Ocean [3]. Fig.1 shows in double logarithmic scale a spectrum of pulse pressure in the range of 0.8 - 20 Hz as an illustrative purpose. From the Fig.1 can well be seen the linear dependence that testifies to power low of the spectral component amplitude decrease of the pulse pressure with the increasing of frequency : $P(\omega) \sim \omega^{-n}$. Here, P -is the spectral component amplitude of the pulse pressure, $\omega$ -is the cyclic frequency and n -is the power exponent. The experimental value of power exponent n found after the processing of the frequency spectra recorded in different days appeared to be $n=0.9 \pm 0.1$.

The feature of the received spectra is appeared to be that in some days on the background of the power decrease of the noise spectrum the expulsion are observed which conform with the infrasound waves with the characteristic frequency of 3 - 5 Hz. Absolute infrasound levels recorded in the period of expedition were oscillated from 80 up to 100 dB, i.e. the sound pressure value in infrasound wave coming from natural sources surrounded the man was order 1 Pa.




It is known that the infrasound coming from the powerfull natural sources spreads on many hundred kilometers as well as




on the sea. and in definite days settles at the continents, i.e. this is an infrasound background which is always presented around us.

Now let us see in what conditions from the infrasound point of view are the workers of the individual cabinets being. Fig.2 a,b,c show three noise spectra measured :a - in the plant director cabinet; b - in the first pro-rector of the Moscow University cabinet; c - in the rector of the Kazan University cabinet. As can be seen from the given spectra the maximum levels in the noise spectra are observed on the infrasound frequencies. The levels of these noises are in the range of 60 - 70 dB. The numerical frequency values defined the main infrasound level in the given apartment characterize the industrial sources disposed in the neighboring buildings or in the same building.

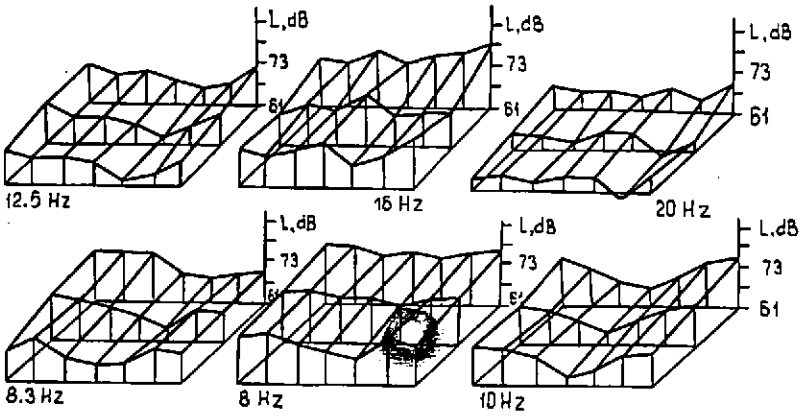
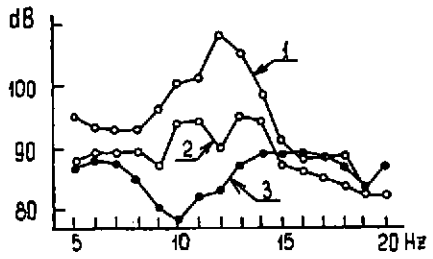



Fig.3 show the special distribution of the infrasound

noise in the capacitor winding shop in the range of 6.3 - 20 Hz. As can be seen from this figure, the infrasound noise distribution is extremely irregular. At the same frequency the neighboring part of the shop might be different on the infrasound level up to 20 dB and reach in some places 80 dB.




In order to have an idea about the infrasound noises, with which a person meets every day, it is necessary to consider the noise spectra in transport means. More often we are in the cars and so it is appropriate in this article to show the infrasound noise spectra measured on the roods of the districts near Moscow.

On the Fig.4 are presented the infrasound spectra in the saloon of the cars : 1-ZIL 114, 2-Cadillac Flitwud 75, 3-Mercedes 600 at the constant speed movement of 100 km/hour. These cars are the ones almost of the same class, the measurement point is the right back seat. The sound pressure level and spectrum depend on the car type. It is difficult for us to compare the car price and the infrasound noise level in it but still the definite tendency is observed.

Perhaps a modern person meets more often the infrasound noise of such high level as 80 - 100 dB in transport and so we consider advisable to carry out investigations studying the influence of the infrasound with a level not more than 100 dB on a person. The higher levels are met extremely seldom and perform as a rule the special professional character.

Another conclusion to which we have come when carrying out the study of the infrasound influence on a person is that the infrasound pressure value doesn't reflect adequately the person reaction character and doesn't permit to judge about the person health change.

For example, in a shop we can find different places where the infrasound level is equal to 70 dB. However in some such places the workers don't complain of the increased fatiguability, but in other places with the same pressure level the workers don't express complaint. In our opinion this connected with different distribution of other, for example, power characteristics of sound field in these places. We consider that in those places where the active intensity rotor has a high value a person feels well and doesn't notice the infrasound influence and in those places where this value is near zero there appeared an unpleasant sensation of the permanent depression. In the last last anomalously active places where the rotor is equal to zero and constitute only 30% of the whole shop area the workers are ill and complain of fatiguability more often.

In the laboratory conditions we made an attempt to model the infrasound field in the premises in such a way that at the same infrasound pressure level of 90 dB to create two regions of the infrasound field in the same places : in one region the active intensity rotor had a zero value (the zone D), and in another region the active intensity rotor had a value different from zero (the zone V).

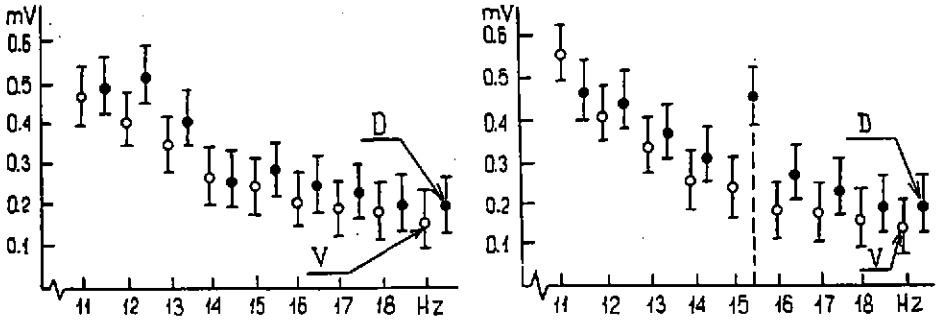



Fig.5. Spectra of signal describing blood flow process.
a) Without harmonic infranoise. b) With infranoise induced.

On the Fig.5 are presented the spectra of human blood circulation made by the electrocardiograph in zone V and in zone D at the same sound pressure level of 90 dB. On the graph is clearly seen that only in zone D where the active intensity rotor is equal to zero in the electrocardiogram spectrum there observed a component on the infrasound influence frequency and in zone V this component is not observed [4].

One of the conclusion of our investigations is that the infrasound noises act directly on the circulatory and nervous systems of a person and do not act directly on the organs of hearing as it was expected.

In the conclusion it is necessary to point out that the study of the low frequency noise action on a person must be carried out under the full control of all parameters of the noise field in the zone of carrying out the biological and physiological investigations. This thesis has an indirect confirmation that a person at home, at work and in transport has the favorite places to stay in which he feels himself more comfortable. In our opinion not the last role in this choice plays the spatial distribution of power parameters of the infrasound field in the exclusive volumes which can be successfully modeled on the modern equipment [5,6].

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