Low-frequency 'hum' may permeate the environment

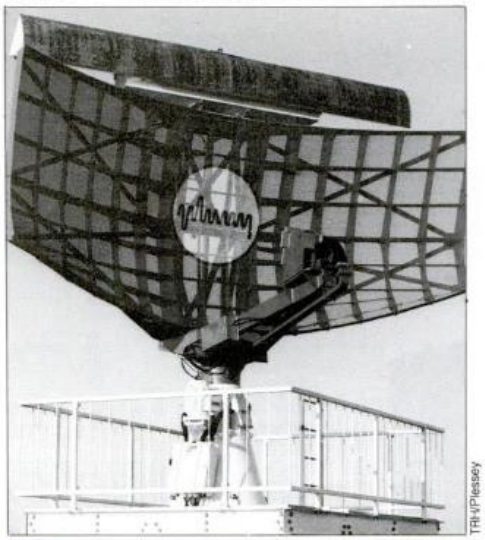
Barry Fox

PEOPLE who hear an odd "throbbing" sound, which their doctors cannot explain and which others cannot hear, may not be imagining it. The "hum" reported by sufferers seems to be a sound in the range 20 to 100 hertz. Its source may be either powerful microwave transmitters, such as military radars, or the high-pressure pipelines operated by British Gas.

Last month, people from all round Britain gathered over a weekend at the Royal Society of Medicine in London. The conference was organised by Coghill Research Associates of Pontypool, Wales, consultants on environmental sound.

Roger Coghill believes that energy at radio frequencies, particularly in the range of a few gigahertz to a few tens of gigahertz used for radar, excites directly the hair cells in the inner ear. This either causes the hairs to generate signals which the brain perceives as sound, or damages the hairs so that the sufferer's hearing mechanism becomes unstable and produces nerve impulses which the brain interprets as sound.

The first serious studies of this effect were carried out in the early 1960s by Allen Frey of General Electric's Advanced Electronic Centre at Cornell University (*Aerospace Medicine*, vol 32, p 1140). More recently, the US Office of Naval Research sponsored James Lin of Wayne State University, Detroit, to study noises "heard" near radar transmitters.



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Radar transmitters can dump heat into brain tissue, creating a thermal wave in the skull. This can be heard

Lin found that people who are exposed to pulses of microwave radiation—from a radar system, for instance—hear a sound that appears to originate from within, or behind, the head (*Proceedings of the Institute of Electrical and Electronic Engineers*, vol 68, No 1, 1980).

Lin's explanation was that the microwave energy dumps heat energy into the brain tissue. This causes thermal waves to propagate down through the bone and activate receptors in the inner ear.

According to Ann Silk, an optician who lives in the Chiltern Hills, many people in the area hear the hum. She believes that research by the Ministry of Defence supports the idea that the hum is caused by radio transmissions.

A defence document published earlier this year states: "It is possible to hear the modulation frequency of pulsed microwave transmissions . . . The mechanism for this phenomenon is a small localised temperature rise in the head causing a pressure wave which reaches the cochlea." (*Defence Standard* 05/74/Issue 1). The MoD's document also confirms that this effect may be perceptible even at low levels of power "in some individuals".

Others who attended the meeting in London remain convinced that what they are hearing is low-frequency noise conducted either by sound waves in the air or vibrations through the ground. Paul Wallace of Poole in Dorset started to hear the hum in 1967. In the mid-1970s, scientists at the Institute of Sound and Vibration Research at the University of Southampton took an interest.

R. N. Vasudevan and Colin Gordon used a sensitive meter to measure the levels of sound and a tape recorder to monitor low-frequency sound in the New Forest and rural areas near Bournemouth, including Wallace's home. The researchers also interviewed sufferers. They reported a number of common factors (*Applied Acoustics*, vol 10, 1977).

They found that the hum is often so close to being inaudible that most people are not able to hear it. The sound is usually heard indoors. People hear it most often at night when there is less background noise. Some sufferers describe the sound as like "a diesel truck with its engine idling". Although the noise has components at high frequencies, low frequencies always dominate.

Significantly, the researchers of the University of Southampton also heard the hum. Their conclusion was that the "throbbing sound" and "unbalanced spectrum" was the result of "low-frequency noises generated by distant industrial sources".

The normal threshold of human hearing is arbitrarily set at 0 decibels at a frequency of 1000 hertz but rises to around 40 dB at 50 hertz. The levels of sound pressure measured by the researchers at the University of Southampton at these low frequencies were at the threshold, implying that only people with sensitive hearing would hear the hum.

Another sufferer, Hugh Witherington of Peterborough, believes that British Gas is the source of this acoustic effect. He notes that over the past 20 years—the period in which the hum has become a nuisance—the company has been installing a nationwide distribution system which uses powerful gas turbines to pump natural gas through underground pipes. British Gas confirms that it began the conversion in 1966 and had covered Britain by 1977.

According to Witherington, British Gas has admitted that it loses many megawatts of energy through friction and sound as it pumps gas along its pipelines. Witherington says that the pipes resonate like organ pipes, amplifying low-frequency sound which then propagates up through the ground. The throbbing noise and unbalanced sound spectrum recorded by the University of Southampton can be explained, because the load on the turbines varies with consumer drain on the gas supply.

The sound is most likely to be heard inside a house because the resonances are created by a closed room, which acts like a tuned chamber.

Witherington has spent many years driving through the night, listening for the characteristic throb of the hum and plotting on a map where he hears it. He finds the sound follows the route of gas pipelines, with audible hum extending several kilometres either side of the gas line.

Witherington wants the Department of the Environment to recognise that the hum is real and that pipelines belonging to British Gas are the cause for most sufferers. He also believes that the company should start a research programme to quantify the nuisance and make whatever modifications are necessary to reduce the sound levels generated both by the turbines and the pipelines. British Gas says it has had "only occasional" complaints about noise from pipelines. □

Ozone loss extends beyond Antarctic hole

THE HOLE in the ozone layer above Antarctica returned in the spring of 1989. But researchers in the US also found that ozone was significantly depleted far beyond the boundaries of that hole (*Nature*, vol 342, p 233).

According to the scientists, from the US National Oceanic and Atmospheric Administration's Aeronomy Laboratory, and the University of Colorado (both in Boulder), "the geographic extent of the ozone loss [is] larger than that generally identified [and] ozone is lost earlier in the year than previously reported".

They base their conclusions on measurements made by the ER2 research aircraft on a flight between California and Chile. The measurements show that at all southern latitudes down to 50 degrees, as much as 15 per cent of the stratospheric ozone was lost in August, and 30 per cent in September. This is outside the region subject to polar temperatures.

Above Antarctica itself, chemical reactions that take place on the surfaces of ice particles release chlorine in an active form. This attacks ozone. Outside this polar region, however, there are few ice particles. One explanation for ozone loss in these areas is that active chlorine is being released by similar reactions taking place on the surfaces of sulphuric acid droplets. □