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TETRA ~ is your health at risk? by Alasdair Philips

Are you being asked to use a system that may cause you long-term adverse health problems?

In March 2000 BT announced a £2.5bn contract to roll out TETRA in England for the new Police mobile radio service, chosen and paid for by the Home Office. **TE**rrestrial **T**runked **RA**dio, is a new system designed to provide secure and fast radio communications for the emergency services and corporate users. With the support of the European Commission, the TETRA standard has been developed over a number of years by European Telecommunications Standards Institute (ETSI) members to meet the future needs of emergency services throughout Europe and beyond. TETRA builds upon the experience gained with previous radio systems including the successful development of the GSM digital mobile phone system during the 1980s. The work started in 1990 and the first standards were ready in 1995. TETRA offers fast call set-up time, excellent group communication support with remote or local call centres, direct operation between handsets, data handling for maps and documents, and excellent security features.

It sounds wonderful. So why are we already hearing about interference problems? Radios needing to be turned off when near life-support equipment (difficult at many RTAs, etc.) or even when near breathalysers or vehicle speed check equipment. Worries about possible adverse health effects have also been raised.

Existing Police radio equipment is mainly 'single carrier FM'. What this means is that each radio uses all of the radio-frequency carrier whenever it is transmitting, just like VHF FM radio stations. This kind of signal has been around for many years and is generally thought not to be dangerous below levels at which it causes tissue heating - which are higher than those to which officers are exposed from their handsets and vehicle radios.

Having just one user per radio signal is not an efficient way to use radio frequencies. The simplest way to add extra users is to compress and encode their speech (etc) into a small 'packet', and then to fit a series of these, one after another, on to the carrier signal. This is called TDMA (Time Division Multiple Access). Newer systems such as the G3 phones will be using CDMA (Code Division Multiple Access) modulation and will be inherently safer as they do not pulse regularly. The GSM phone system uses 8 user slots per radio signal, repeated 217 times every second. TETRA has only 4 user slots per carrier, and could pulse at the same rate, or even faster, but instead the committees chose to use 17.6 Hertz (17.6 pulses each second). For a number of reasons this seems an unwise choice.

Firstly, electronic equipment operation is interfered with by pulsing signals, and the slower they pulse, the harder it is to filter them out. Hold a GSM mobile phone next to an ordinary radio and dial out. You will hear the characteristic pulsing interfering with radio reception. When they were first brought out there were some extraordinary examples of interference problems. On one make of coach, the electronically controlled automatic gearbox would change gear at the wrong time when passengers in certain seats used a GSM phone. This sort of incident led to mobile-phone bans in hospitals and on aircraft.

You would have thought that this would have made the TETRA committees careful about their choice of pulsing frequency. Apparently not, for they chose 17.6 Hz, a <u>much</u> worse pulse rate for interference effects, not only with equipment but also with people. It can only be that there were no experts on bioelectromagnetics on these committees.

Concern about ELF (Extremely Low Frequency) pulsed radiation effects goes right back to the 1960s when Eastern Bloc countries started experimenting with 'mind-control' non-lethal weapons. By 1976, a US Department of Defense document [DST-1810S-074-76] was reporting: *"The potential for the development of a number of antipersonnel weapons is suggested by the research. ... Sounds and possibly even words which appear to be originating inside the targets head can be induced by signal modulation at very low average power densities. ... Animal experiments have demonstrated the use of low-level microwave signals to produce death by heart seizure or by neurological pathologies resulting from breaching the blood-brain barrier."* Work in these areas continued as confirmed by a talk on the

"Application of ELF Electromagnetic Fields to Non-Lethal Weapons" at a classified Los Alamos Conference in November 1993 during the period when the TETRA Standard was being developed.

One of the first voices in the West to raise concern was Professor Ross Adey. Although interested in radio and the development of radar from an early age, he qualified in medicine in Australia during the war and then came to Oxford to study brain physiology. He was appointed as a professor at University of California in 1954 and in 1961 joined their newly formed Brain Research Institute. In 1965 he was appointed as Director of the new Space Biology Laboratory. The projects his teams worked on were related to brain activity of service personnel, including the effects of pulsed ELF and microwave radiation, and were funded by NASA, ARPA, NSF, USAF and USN. Since then he has remained at the forefront of research into these matters. He commented to me recently "*I would be very concerned about a 4-watt Tetra hand-held radio against my head day after day"*.

So what is the cause of this concern? Back in the mid-1960s Adey and colleagues revolutionised our understanding of the way brains cell operate. During the next twenty years many papers were published showing that ELF electromagnetic fields affected the way calcium ions move in brain tissue and the way this affects the inner working of the cells. Living cells are enclosed by a strong protective membrane (skin) and communicate with the outside world through electrically charged protein strands that stick out from their surface. These carry signals into the cell interior where they regulate growth, development and cell division. By 1976 low level electromagnetic field effects had been shown to occur across the ELF range, peaking between about 12 and 20 Hz. The effects were seen most clearly with the ELF signals amplitude modulated on to microwaves, such as those that TETRA handsets use. The microwaves penetrate brain tissue and effectively 'carry' the ELF pulsing deep into the brain. There is also considerable evidence that low levels of pulsed microwaves can cause the blood-brain barrier to allow toxins to reach the brain.

The current safety guidelines are entirely based on preventing human tissue heating, and are not concerned with these pulsing effects. These ELF signals interfere with cell communication probably in a similar way to a GSM mobile phone interfering with radio reception, described earlier. This interference can cause 'noise overload' (eg loud buzzing) or mislead the living organism into thinking something unusual is happening by simulating normal internal signals. Both could cause adverse health effects. That is why it is sensible to avoid signals that pulse in the biological range, primarily between 1 and 100 Hz.

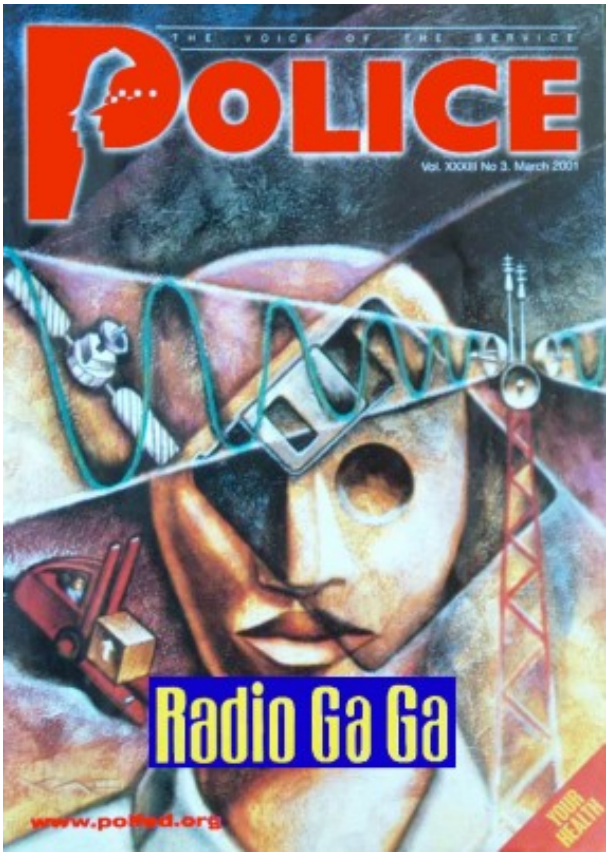
Some of this work was considered by the UK Independent Expert Group on Mobiole Phones in the "Stewart Report" in paras 5.53 to 5.59, although they excluded TETRA from consideration (4.19) as it was not intended for general public use. They concluded (5.59) *"As a precautionary measure, amplitude modulation around 16 Hz should be avoided, if possible, in future developments of signal coding"*. They say "around 16 Hz" because effects can be seen to occur over quite a wide range of ELF frequencies, and in some cases the peak frequency is dependent on the strength of the Earth's local magnetic field. TETRA uses a pulsing frequency close to 16 Hz.

Given the relevant published scientific background information it would be reasonable to assume that TETRA transmitters (handsets and base-stations) would have been extensively tested for biological effects in living organisms, including humans. However, in an October 2000 letter, Health Minister Yvette Cooper, admits: *"I am informed that there have been several studies into the possible biological effects of the TETRA signal and* ***although none of these were on humans****, the results do not indicate any adverse health effects. In addition, there is now a substantial body of evidence relating to the possible health effects of radio signals at many frequencies, including pulsed signals"*.

In total, around the world, there appear to be six small studies into TETRA signal bio-effects, five using cell cultures, and one using live hamsters. Only one of these studies is published in a scientific journal.

No human safety work has so far been done using TETRA signals. The COST244bis report on the "Possible Health Effects Related to the Use of Radiotelephones", funded by DGXIII of the European Commission, merely mentions TETRA in a list of systems and makes no comments about it.

I believe that some proper human testing should be done before exposing police personnel to potential long-term health problems from their use of TETRA phones.



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Originally qualifying in both electronics and agriculture in the 1970s, Alasdair Philips has been studying and writing on the subject of the biological effects of non-ionising electromagnetic radiation since 1986. He is now recognised as an independent UK expert on these matters. He has given Expert Evidence on EMF-bioeffects to High Court Judicial Reviews, Public Inquiries, Wayleave Hearings and Lands Tribunals. He has been a platform speaker at many technical conferences on these matters. He is a member of Scientists for Global Responsibility and a founder member of Powerwatch, a consumer information service, providing information on the possible adverse health effects of non-ionising radiation. http://www.powerwatch.org.uk